The New Hampshire Climate Change Local Impact Assessment Project (LIAP)

Final Report

July 2002

New Hampshire Department of Environmental Services

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The New Hampshire Climate Change Local Impact Assessment Project (LIAP)

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The Honorable Jeanne Shaheen
Governor

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EXECUTIVE SUMMARY

The purpose of the New Hampshire Climate Change Local Impact Assessment Project (LIAP) was to bring a greater understanding of the climate change issue and its potential impacts to New Hampshire stakeholders. LIAP did this by providing information to forestry and water stakeholders about the current state of scientific understanding of climate change at the global, national, regional, and state levels.

From the scientific information provided in written form, and through a presentation at a one-day stakeholder meeting, LIAP determined whether:

- the information helped stakeholders understand the climate change issue (if stakeholders had little prior knowledge) or whether it changed their current understanding; and
- learning more about climate change resulted in agreement by stakeholders about appropriate actions to address climate change at the individual, business and governmental levels.

Results from the facilitated session at the meeting and exit surveys completed by the stakeholders showed that, indeed, greater understanding of climate change resulted. Many stakeholders felt the science behind climate change was clear and convincing while some others felt the climate change models were global in nature and difficult to interpret at the regional or local level. Further, although individual stakeholder opinions ranged widely, the majority supported at least some actions by individuals, businesses, and federal and state government to address the potential effects of climate change.

The LIAP process was the first step to better understanding of a scientifically complex and publicly controversial issue. At least three additional steps are needed to build on that work:

(1) Support additional research to:
   a. better assess the potential impacts of climate change at the regional and local level;
   b. collect and analyze local and regional records of climatic patterns;
   c. apply climate models spatially, and more locally;

(2) Improve the understanding of the ramifications of climate variability and change the state's affected economic sectors (e.g., forestry, water, tourism, real estate, etc); and

(3) Bring research results, and any emerging scientific consensus, to the public forum so that specific stakeholders, and general public, have the information to help make more informed decisions.

This report provides an outline of both the LIAP process, and the findings. For more information, please contact Joanne Morin, NH DES, Division of Air Resources, 6 Hazen Drive, PO Box 95, Concord, NH 03302-0095 (603-271-5552) jmorin@des.state.nh.us.

OVERVIEW

The purpose of the New Hampshire Climate Change Local Impact Assessment Project (LIAP) was to bring a greater understanding of the complex issue of climate change and its potential impacts to New Hampshire stakeholders. The intent was to ascertain the significance of current climate change science to forestry and water resource managers and what level of action, if any, they would support to mitigate climate change. The LIAP process blended two distinct approaches—*comparative risk assessment*, a science-based process used to identify and rank risks based on likelihood of impact, and *deliberative polling*, where non-expert stakeholders are provided with reader-friendly, peer-reviewed scientific analysis, and asked if and how such information influences their understanding of an issue. This report summarizes the LIAP process and findings of the stakeholder participation.

The New Hampshire Department of Environmental Services (DES) divided the project into three phases:

Phase 1: Assembling multi-scale documentation of impacts of climate change by compiling concise, peer-reviewed reference documents describing current scientific consensus on climate variability and change at the international, national, and regional levels.

Phase 2: Identifying areas of state-based scientific consensus on potential likelihood of impacts to forests and water by convening New Hampshire research scientists and using a comparative risk assessment to identify potential impacts to New Hampshire water and forest resources from climate change.

Phase 3: Providing stakeholder education and assessing their opinions by presenting stakeholders with the most current international, national, regional, and local (from Phase I and II) scientific information on climate change and leading them through an interactive discussion of the issues relating to their respective resource. Using deliberate polling, the degree to which each stakeholder supported actions by individuals, business and/or government to mitigate the impacts of climate change was also assessed.

In Phase 1, the LIAP consultant team identified the current scientific analysis on climate variability and change at the international, national, and regional scales (see Appendix A for members of the consultant team). The team then provided summaries and illustrative excerpts to research scientists working in New Hampshire on forestry and water issues. The LIAP consultant team later provided this information to key New Hampshire stakeholders who work directly in forestry and water resources (e.g., loggers, marinas, park rangers, etc.) or whose businesses are closely linked to forestry and water resources (e.g., tourism industry).

During Phase 2, forty-four scientists, whose research directly involves New Hampshire forest and water resources, met in a series of workshops to discuss the assembled scientific documentation and analyze comparative risk from climate change. They identified the following issues as having likely impacts in New Hampshire from climate change:

Forestry Issues
HIGH CONSENSUS
• Maple Syrup Production • Wildlife • Vector-borne Disease (Lyme, encephalitis, etc.)
MODERATE CONSENSUS
• Forest Productivity • Tree Species Composition and Forest Type Distribution • Fall Foliage
Water Issues
HIGH CONSENSUS
• Flooding • Snow Depth/Pack/Duration • Erosion, Sedimentation, and Pollution Loads • Harmful Algal Blooms in Freshwater Systems • Coldwater Fisheries • Warmwater Fisheries • Shellfish Resources • Drinking Water Supplies • Saltwater Incursions • Waterborne Diseases • Surface Water Quality • Non-native Species
MODERATE CONSENSUS
• Droughts • Algal Productivity
LOW CONSENSUS
• Wetlands

The LIAP consultant team prepared consensus papers on each issue identifying the likelihood, supporting research, and expected direction of potential changes. These issue papers are contained in the appendices to this report.

In Phase 3, New Hampshire forest and water resource stakeholders were identified and asked to participate in a one-day meeting. Prior to the workshop, the stakeholders received the scientific analysis assembled in Phase 1 and the issue papers developed during Phase 2. In addition, a

summary of current statistics on critical economic sectors associated with potential water and forest impacts was developed and distributed to provide stakeholders with an economic context for potential impacts. Stakeholder concerns and reactions were assessed through facilitated discussions and a final survey (i.e., deliberative polling).

The results of the survey, summarized in this report, indicated that stakeholders developed an increased awareness of the climate change issue and were now considering that climate change may have real, local consequences. For instance, given the current lack of political support for establishing mandatory measures to address climate change (i.e., mandatory greenhouse gas reductions), it was significant that by the end of the meeting a majority of water and forestry stakeholders indicated that they actually supported several regulatory mechanisms for mitigation climate change including:

- Federal regulation of CO_2 and other air pollutant emissions from power plants (65% of water stakeholders and 75% of forest stakeholders).
- State mandate for the purchase of a percentage of energy from renewable resources in the State (71% of water stakeholders and 62.5% of forest stakeholders).
- State regulation of energy efficiency in new state buildings (68% of water stakeholders and 61% of forest stakeholders).

Although some participants clearly felt immediate action at all levels was called for, others still felt that global approaches were more appropriate to a global problem where local impacts were still uncertain. However on balance, the comments received through the stakeholder discussions and the final survey indicated that the LIAP succeeded in communicating potential climate change impacts to the local level and that this education enhanced the stakeholders perception of the problem.

When people whose personal and business interests may be affected by climate change are given a local perspective on what is known about climate change and its potential local impacts, they were more supportive of measures to mitigate greenhouse gas emissions. Since most measures proposed in the current regulatory environment are voluntary, consumer-choice approaches to improve energy use efficiency, stakeholder "buy-in" to their importance and relevance is critical.

More intensive research is needed to better assess the potential impacts of climate change at the regional and local level. However, this project demonstrated that identifying the potential impacts from climate change in a meaningful way to stakeholders influences their perception of the significance of the problem. It is clear that the complexity of issues related to climate change is not completely communicated in the media and that misunderstandings are common. Stakeholders need information relevant to their particular sectors to understand how climate change could potentially impact their lifestyles and livelihood.

1.0 BACKGROUND AND PURPOSE

The New Hampshire Climate Change Local Impact Assessment Project (LIAP) was developed out of a desire to bring the potential impacts of climate change to a local level. Until recently, the general news media rarely focused on climate change, and if it did, only an overview of global warming and its worldwide impacts was given. The general public does not usually distinguish between global warming (an increase in the average global temperatures), climate change (changes in the complex interactions that drive the earth's climate) and climate variability (the temporal and geographic cycles and extremes) and has little, if any, information about potential local impacts. We wanted to know whether the public would be more inclined to support or take direct actions to mitigate climate change if they understood how regional and local impacts of climate change might affect their lives.

In 2000-2001, the New Hampshire Department of Environmental Services (DES) obtained a grant from the US Environmental Protection Agency (EPA) to conduct a local impact assessment project as a national pilot project to explore whether better public understanding of climate change would lead key stakeholders to develop more interest in individual, state or federal actions. The objective was to develop a process to identify potential climate change impacts to state resources, provide this information in an effective and efficient manner to key stakeholders, and finally to assess the motivation of the stakeholders to support or take actions after considering this information. The project was led by a team of consultants working with scientists and stakeholders, focusing on New Hampshire's forest and water resources because they are critical to the State's identity and the quality of life of its citizens (see Appendix A for a list of participants and work team members).

The LIAP goals were to:

- Assemble and provide objective information about potential relevant local impacts of climate variability and change on New Hampshire forests and waters to stakeholders.

- Stimulate discussion among New Hampshire forest and water resource managers about their assessment of the information to identify areas of consensus about local impacts.

- Educate stakeholders about the potential local impacts of climate variability and change, and assess their opinions as to the significance of this information, and what actions, if any, they would support at individual, business and government levels.

2.0 OVERVIEW OF PROJECT APPROACH

The approach to LIAP involved three phases:

Phase 1: Assembling multi-scale documentation of impacts of climate change by compiling concise, peer-reviewed reference documents describing current scientific consensus on climate variability and change at the international, national, and regional levels.

Phase 2: Identifying areas of state-based scientific consensus on potential likelihood of impacts to forests and water by convening New Hampshire research scientists and using a comparative risk assessment to identify potential impacts to New Hampshire water and forest resources from climate change.

Phase 3: Providing stakeholder education and assessing their opinions by presenting stakeholders with the most current international, national, regional, and local (from Phase I and II) scientific information on climate change and leading them through an interactive discussion of the issues relating to their respective resource. Using deliberate polling, assessing whether information on local impacts heightened stakeholders' concern or motivation to support actions by individuals, business and/or government to mitigate the impacts of climate change.

Table 2-1 presents the questions asked during each phase of the project and what resources were used to provide the answers. A list of participants in LIAP (scientists, stakeholders, and work team members) is provided in Appendix A.

In Phase 1, the current scientific analysis on climate variability and change at the international, national, and regional scales were identified. Summaries and illustrative excerpts were assembled. In Phase 2, key forestry and water scientists working in New Hampshire were identified and asked to participate in a number of technical work sessions. Given the predictions of climate variability and change by international climatic models, scientists were asked to identify potential impacts to New Hampshire forest and water resources and rank the likelihood of each impact. This approach, called *comparative risk assessment,* is further described in Section 2.1. Phase 3 focused on stakeholder education and input involving a one-day stakeholder meeting, which is further described in Section 2.3. A detailed chronology of LIAP is provided in Appendix B.

TABLE 2-1. PROJECT PHASES

QUESTIONS	RESOURCES/ PARTICIPANTS	PROCESS
Phase 1: What is the current scientific consensus on likelihood of climate variability? What is the basis for this scientific consensus? In other words, how do we know the likelihood of climate variability from models, sector experts and data?	BACKGROUND INTERNATIONAL, NATIONAL, AND REGIONAL REPORTS: • *Intergovernmental Panel on Climate Change (IPCC) Third Report Summary* • *National Assessment* • *New England Regional Assessment*	Peer-reviewed science, describing likelihood of changes, based on models, sector experts, and regional and local New Hampshire data on temperature, snow pack depth and duration, and ice out records.
Phase 2: What might the projected changes mean for New Hampshire forests and water systems?	NEW HAMPSHIRE FORESTRY AND WATER SCIENTISTS	Collaborative identification of potential impacts to New Hampshire forests and water from predicted changes in temperature, precipitation, and climate variability based on current international climatic models
Phase 3: What is the significance of the scientific information on potential climate change impacts to stakeholders? What level of action, if any, would you support by individuals, business, and government take to reduce any significant impacts of climate variability and change?	NEW HAMPSHIRE FORESTRY AND WATER STAKEHOLDERS	Facilitated discussion groups and deliberative polling.

2.1 DEVELOPING SCIENTIFIC CONSENSUS ON NEW HAMPSHIRE IMPACTS

Forty-four leading forestry and water scientists working in New Hampshire were identified and recruited to participate in LIAP. In December, 2000, they received summaries of current national and regional reports on climate variability and change (see Table 2-2), along with an initial list of climate change related issues affecting forest health and water quality and quantity, compiled from recent scientific reports.

TABLE 2-2. REFERENCE DOCUMENTS PROVIDED TO SCIENTISTS

SCALE	YEAR	REPORT	SOURCE
Global	2001	*Third Assessment Report* summary (www.ipcc.ch)	Intergovernmental Panel on Climate Change (IPCC)
National	2000	*Climate Change Impacts on the US—The Potential Consequences of Climate Variability and Change* (www.usgcrp.gov)	National Assessment Synthesis Team of the US Global Climate Change Research Program
Northeast Region	2001	*Preparing for a Changing Climate—The Potential Consequences of Climate Variability and Change, New England Region Overview*), www.necci.sr.unh.edu.	New England Regional Assessment Team for the US Global Climate Change Research Program
New England	1997	*Seasons of Change—Global Warming and New England's White Mountains*	Environmental Defense Fund

In undertaking the first and second phases of the project, LIAP was fortunate to build on the ongoing work at the University of New Hampshire, Earth, Oceans, and Space Complex Systems Research Center Global Climate Change Program (UNH). UNH had been working on a regional assessment of climate variability and change since the mid 1990's as one of nine regions participating in the US Global Climate Change Research Program.[1] The *New England Regional Assessment* was also used as a basis for examining potential local impacts to forestry and water resources.[2] A two-page summary of the major conclusions of the *New England Regional Assessment* is provided in Appendix C.

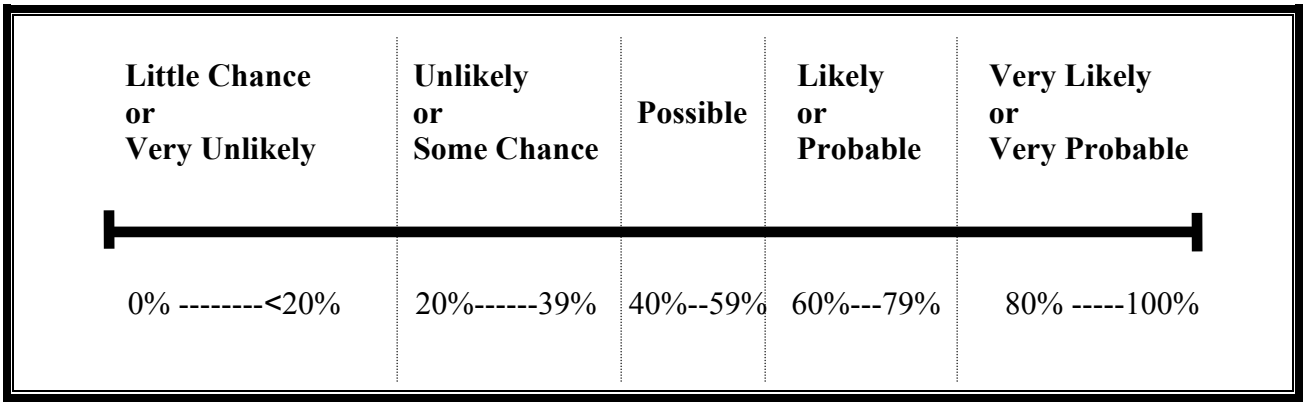
After an initial joint meeting of forestry and water scientists in January 2001, three additional meetings were held in February 2001 to further refine the water resources issues list. In an iterative process, scientists were asked to identify the forestry and water issues most likely to be

[1] U.S. Global Change Research Program, U.S. National Assessment Synthesis Team, 2000, *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change, s*ee http://www.usgcrp.gov .

[2] U.S. Global Change Research Program, New England Regional Assessment Group, August 2001, *New England Regional Overview PREPARING FOR A CHANGING CLIMATE The Potential Consequences of Climate Variability and Change*, see http://www.necci.sr.unh.edu/.

impacted by climate variability and change, given the predictions of warmer temperatures and increased precipitation predicted by international climatic models. The scientists used the likelihood continuum developed by the national assessment to help describe their extent of consensus (see Figure 2-1).

FIGURE 2-1. COMMON LANGUAGE TO EXPRESS CONSIDERED JUDGMENT OF LIKELIHOOD USED AT THE LIAP SCIENTISTS' FORUMS



From U.S. Global Change Research Program, U.S. National Assessment Synthesis Team, 2000, *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change* page 5.

The participating scientists identified the forestry and water issues in Table 2-3 as those areas most likely to be impacted from climate change. Note that these issues were chosen based on a high level of scientific consensus, or agreement on the issue, not by an estimate of significance or importance to the state, or to forestry or water managers. In addition, other impacts may also occur which may have positive and/or negative aspects. The scientists also developed a rationale for each issue describing the type of impact expected (e.g., likelihood of chance) and the reason why the impact is expected to occur. The forestry and water issue papers developed are provided in Appendix D.

TABLE 2-3. FORESTRY AND WATER ISSUES BY DEGREE OF CONSENSUS AMONG NEW HAMPSHIRE SCIENTISTS

Forestry Issues
HIGH CONSENSUS
• Maple Syrup Production • Wildlife • Vector-borne Disease (Lyme, encephalitis, etc.)
MODERATE CONSENSUS
• Forest Productivity • Tree Species Composition and Forest Type Distribution • Fall Foliage
Water Issues
HIGH CONSENSUS
• Flooding • Snow Depth/Pack/Duration • Erosion, Sedimentation, and Pollution Loads • Harmful Algal Blooms in Freshwater Systems • Coldwater Fisheries • Warmwater Fisheries • Shellfish Resources • Drinking Water Supplies • Saltwater Incursions • Waterborne Diseases • Surface Water Quality • Non-native Species
MODERATE CONSENSUS
• Droughts • Algal Productivity
LOW CONSENSUS
• Wetlands

NOTE: *Issues are listed in order of scientific consensus, or agreement on the issue, not by an estimate of significance or importance to the state, or to forestry or water managers.*

2.2 ECONOMIC STATISTICS FOR POTENTIALLY AFFECTED SECTORS

As part of LIAP, scientists assessed the potential impacts on our forestry and water resources that may result from climate change. These potential impacts affect various economic sectors, including tourism, forest-based manufacturing, municipal and state infrastructure, and fisheries. Gallagher, Callahan & Gartrell, a New Hampshire-based legal and consulting firm, gathered existing economic statistics on the economic sectors associated with potential water and forest impacts. The table in Appendix E, which consists of a summary of statistics for industries and

issues identified by the participating scientists was provided to the stakeholders. It is important to note that no original research or studies were conducted, nor was modeling performed to generate new economic data. The data provided was strictly from readily available sources. These statistics were compiled only to provide a general economic context to consider potential forestry and water impacts from climate change. These data did not reflect estimates of the specific economic impacts that may occur as a result of climate change, or imply that potential economic impacts would be positive or negative.

2.3 ASSESSING FORESTRY AND WATER STAKEHOLDER RESPONSES

In Phase 3 of LIAP process, a list of stakeholders with personal and business interests in New Hampshire forest and water resources were identified and asked to participate in a one-day meeting (see Appendix A for list of stakeholders). The Stakeholders Meeting was held in Concord, New Hampshire on 25 May 2001. Prior to the workshop, the stakeholders had received the reference documents listed in Table 2-4, which provided the scientific consensus of climate change impacts at the international, national, regional and local levels. They also received the forestry and water issue papers developed during the second phase of LIAP that described the potential local impacts of climate change (see Appendix D). In addition, a summary of current economic statistics on critical economic sectors associated with potential water and forest impacts was developed and provided to the stakeholders at the start of the meeting to assist in their discussions (see Appendix E).

TABLE 2-4. REFERENCE DOCUMENTS PROVIDED TO STAKEHOLDERS

SCALE	YEAR	REPORT	SOURCE
Global	2001	*Third Assessment Report* summary (www.ipcc.ch)	Intergovernmental Panel on Climate Change (IPCC)
National	2000	*Climate Change Impacts on the US—The Potential Consequences of Climate Variability and Change* (www.usgcrp.gov)	National Assessment Synthesis Team of the US Global Climate Change Research Program
Northeast Region	2001	*Preparing for a Changing Climate—The Potential Consequences of Climate Variability and Change, New England Region Overview*), www.necci.sr.unh.edu.	New England Regional Assessment Team for the US Global Climate Change Research Program
Local	2001	*Water and Forestry Issues: Likelihood and Direction of Potential Change* (see Appendix D)	LIAP consultants, from work of NH Water and Forest Scientists
Local	2001	*Economic Statistics on Forestry and Water Issues* (see Appendix E)	Gallagher, Callahan & Gartrell

More than 40 stakeholders attended the daylong workshop, representing New Hampshire tourism, lodging and restaurants, logging, forest products, maple sugaring, ski areas, water supply, and state and local conservation and watershed groups. In the morning, Work Team Members presented an overview of the scientific information at the international, national, regional and local levels, and moderated a question and answer session. In the afternoon, facilitators convened separate forestry and water stakeholder discussion groups, and focused on answering three specific questions:

Question 1: What do you think about the climate change science you've just learned about, and the effects of such changes on New Hampshire forests (or water)?

Question 2: How do such climate changes impact your sector?

Question 3: Based on what you now know, what do you think we should do?

A facilitator-led discussion was then held to identify the significance of impacts to their respective resources. After the discussion groups addressed the three questions, each individual stakeholder completed a survey with their assessment of specific actions, if any, that individuals, business and industry, and government should take to help reduce the projected negative impacts of climate change. The approach used during the Stakeholder Meeting, is referred to as *deliberative polling*, where non-expert stakeholders are provided with reader-friendly, peer-reviewed scientific analysis, and asked if and how such information influences their understanding of an issue. Of those attending, 20 forestry and 18 water stakeholders completed the exit surveys. The findings of discussion groups and stakeholder survey are presented in Sections 3 and 4, respectively.

3.0 FINDINGS OF THE STAKEHOLDER DISCUSSION GROUPS

During the morning session of the 25 May 2001 LIAP Stakeholders Meeting, over 40 forestry and water stakeholders heard a review of the current science on global climate change and variability, an introduction to the *New England Regional Assessment Overview*, and review of the *LIAP Forestry and Water issues papers*, and then participated in a question and answer session. After lunch, stakeholders separated into either a forestry or water discusion group for a two hour facilitated group discussion. Facilitators focused participating stakeholders on answering the three specific questions listed in Section 2.2 above. Responses are summarized in Sections 3.1, 3.2, and 3.3.

3.1 SCIENCE OF CLIMATE CHANGE

QUESTION: *What do you think about what you've read in preparation for this workshop, and what you have heard this morning about global climate change, and its effects on the forests and water of New Hampshire?*

Forestry Stakeholder Response: Generally, participants were pleased that LIAP had synthesized the extensive information about global climate change into a manageable, understandable body of knowledge.

Forestry stakeholders appreciated the available global and regional data, but found it difficult to transfer it to the state level. They agreed that increases in energy use are resulting in increased greenhouse gas (CO_2) emissions; that emissions from other sources (e.g., forestry and agriculture) are not important; and that surface temperatures have increased from 1895 to the present. Some stakeholders believed that enough is currently known to begin addressing the issue through individual actions and public policies. However, this group included many skeptics, who either questioned the reliability of the climate models on which much of the research is based, or who believed that, even with the climatic model data, there was insufficient information on which to base public policy decisions. The group would have appreciated an opportunity to hear from scientists who are skeptical of this data.

Water Stakeholder Response: Participants found the information presented absorbing, helpful, and eye opening. They were eager for an assessment of the potential positive and negative economic effects from different climate change impacts. They felt that the summary statistics provided were a good starting point but didn't reflect the potential costs of various impacts.

3.2 FORESTRY AND WATER SECTOR IMPACTS

QUESTION: *How do such climate changes impact your sector?*

Forestry Stakeholder Response: Participants expressed a wide range of opinions relative to how climate changes impact the forestry sector. One forest landowner welcomed increasing temperatures and the potential for an increasing distribution of oak/pine, because oak has greater commercial value than northern hardwoods. A maple syrup producer, who has been in business

for much of his 60+ years, expected that his generation would be the last to see significant syrup production in his part of southern New Hampshire. Stakeholders were unsure of impacts on forest- and water-based recreation, but anticipated that this industry will adapt, although some current businesses will be lost (e.g., skiing in the southern part of the state). The group recognized some benefits to warming, such as warmer winters making life easier for the elderly. Forestry may be affected negatively if conditions shorten the season during which equipment can operate in the woods. Desertification of other parts of the world may make New Hampshire even more attractive for development, further reducing the state's land base for forestry, agriculture, and recreation.

Water Stakeholder Response: Participants were concerned that if the model projections were correct about changes in precipitation patterns and severity, the present system of dams may not be adequate to withstand more frequent or more severe storms. Water stakeholders also were concerned that the ecological effects of climate change are not yet adequately understood, so it is difficult to assess potential implications for watershed or fisheries management.

3.3 POSSIBLE ACTIONS TO ADDRESS CLIMATE CHANGE

QUESTION: *Based on what you now know, what do you think we should do?*

Forestry Stakeholder Response: Some participants clearly felt that the information provided suggests immediate action at all levels, and particularly at the individual level, focused on energy use. Others felt that global approaches were more appropriate since the issue is global and the science isn't certain, particularly when translated to the local level. All stakeholders felt that any individual, business, or government actions should focus on energy use. Some felt that no government actions were appropriate.

Water Stakeholder Response: Participants considered the acid rain issue to be a good model for raising public awareness and buy-in on a complex scientific issue with public policy components. They saw a role for everyone, and recommended the following approach for future education forums:

i) To strengthen credibility and visibility, develop a consensus position, endorsed by many interests and sectors, that recognizes that climate change is happening;
ii) Develop a simple, concise, and non-judgmental message;
iii) Try to keep recommended actions interesting, "hands on," and "fun."

Water stakeholders believed that many more energy efficient approaches and technologies exist, but are not being introduced into the market, and that the media can play an important role in influencing public behavior.

4.0 FINDINGS OF THE STAKEHOLDER SURVEY

After the discussion groups, stakeholders then took 30 to 45 minutes to complete detailed exit surveys. Appendix F provides the survey results. The four-part survey evaluated whether stakeholders thought the scientific information presented was significant or compelling, and what actions, if any, they supported at an individual, business, or government level to mitigate potential climate change impacts. In the first three sections of the survey (***science of climate change, individual actions***, and ***business and industry actions***), stakeholders ranked a series of statements from "strongly agree" to "strongly disagree."

The responses to the survey were evaluated mathematically and presented in Sections in 4.1 through 4.3. Points were assigned to each response as follows:

Strongly agree	+5	*Strongly disagree*	-5
Agree	+3	*Disagree*	-3
Slightly agree	+1	*Slightly disagree*	-1

The degree of agreement (i.e., how much did the group agrees or disagrees with the statement) was then measured for each statement by summing all the positive and negative points, and dividing by the number of responses. For example:

21 forestry stakeholders answered Question #1 "I have a good understanding of the science of climate change."in the following breakdown:

TABLE 4-1. Amount of Agreement Calculation

Answer	Value assigned to each answer	Number of Stakeholders	Value x No. Stakeholders
Strongly Agree	+5	3	15
Agree	+3	4	12
Slightly Agree	+1	12	12
Slightly Disagree	-1	1	-1
Disagree	-2	1	-3
Strongly Disagree	-5	0	0
		Total	35
35 total score / 21 responses = **1.7**			
Max value (+5 x 21)/21 = 5 Min value (-5 x 21)/21 = -5			

The level of consensus among stakeholders (i.e., how often the stakeholders chose the same answer) was determined by calculating the percentage of the most frequent response to a given question (i.e., # of the most frequent response/total responses x 100). In the above example, the most frequent answer was "slightly agree" chosen by 12 forest stakeholders.

Level of Consensus Calculation
(12 / 21 total responses) x 100 = 57%

The fourth section of the survey (***government actions)*** presented a series of potential government actions, for which participants indicated their preference for no action, outreach and education, voluntary incentives, local regulation, state regulation, federal regulation, or some combination thereof. Preferred alternatives (e.g., voluntary incentives) are summarized in Section 4.4 for each of the twelve potential actions identified.

4.1 THE SCIENCE OF CLIMATE CHANGE

Both groups of stakeholders showed overall support for the statements in this section. Most of the stakeholders chose values of slightly agree to agree. Amount of agreement ranged from 2.3 to 4.6 (maximum possible value of 5.0 to a minimum possible value of -5.0) for water stakeholders and 1.7 to 3.6 for forestry stakeholders. Water stakeholders exhibited a greater consensus on average ranging from 47% to 82% than forestry stakeholders (consensus ranged from 30% to 57%). On average (3.8 vs. 2.5), water stakeholders agreed more than forestry stakeholders with the statements in this section, and on all individual statements but one (#5).

Water stakeholders agreed most strongly (>4.4) and with greatest consensus (>75%) that:

- Industrial and commercial businesses should take action in the area of climate change;
- Non-government organizations such as environmental groups should take action in the area of climate change; and
- Individuals should take action in the area of climate change.

Forest stakeholders agreed most strongly (>3.0) (but with consensus of 43% to 53%) that:

- Human activities (particularly energy use) are the predominant cause of increased concentrations of greenhouse gases leading to climate change; and
- Individuals should take actions in the area of climate change.

Both groups agreed least (1.7, 2.3) with the statement:

- I have a good understanding of the science involved in global climate change.

4.2 INDIVIDUAL ACTIONS

Both groups of stakeholders showed overall support for the statements in this section. Most of the stakeholders agreed to strongly agree with statements on actions individuals can take to

mitigate climate change with agreement ranging from 2.3 to 4.8 for water stakeholders and ranging from 2.5 to 3.7 for forest stakeholders. Greater than 60% of the time, the water stakeholders chose the same answer on this set of questions indicating strong consensus among the group. In contrast, forest stakeholders chose the same answer 48% or about half of the time.

Water stakeholders agreed most (>4.4) with, and reached strong consensus (>75%), on the following statements:

- Individuals should consider fuel efficiency (mpg) when purchasing an automobile.
- Individuals should incorporate energy efficiency into construction or renovation/repair of one's home.
- Individuals should purchase energy efficient lighting and appliances.

With 60% consensus, forestry stakeholders agreed most (>3.5) with the statements:

- Individuals should incorporate energy efficiency into construction or renovation/repair of one's home.
- Individuals should purchase energy efficient lighting and appliances.
- Individuals should take efforts to reduce sprawl.

Water stakeholders agreed least (<3.0) with three statements, with 53% consensus on the first two:

- Individuals should purchase, from their electricity provider, at least some renewable energy.
- Individuals should generate electricity, where feasible, with renewable energy.
- Individuals should car pool on a regular basis.

Forest stakeholders agreed least (<3.0) with the statements with <50% consensus:

- Individuals should purchase at least some renewable energy (form their electricity provider).
- Individuals should car pool on a regular basis.
- Individuals should consider purchasing an alternate fuel vehicle.

4.3 BUSINESS AND INDUSTRY ACTIONS

Both groups of stakeholders showed overall support for the statements in this section. Most stakeholders indicated that they agreed or strongly agreed with the actions business and industry could take to mitigate climate change. Calculated values for amount of agreement ranged from 3.4 to 4.9 for water stakeholders and 2.3 to 3.9 for forestry stakeholders. On average, water stakeholders agreed more strongly than forestry stakeholders with the statements in this section

(3.1 vs. 4.1) and reached a higher level of consensus than forest stakeholders (62% vs. 45%). For example, water stakeholder agreement exceeded 3.3 for all statements in this section.

Both groups showed the greatest agreement with the following two statements with a high degree of consensus among water stakeholders (82% and 94%) and moderate consensus among forestry stakeholders (50% and 63%):

- Purchase energy efficient lighting and equipment.
- Consider fuel efficiency (mpg) when purchasing fleet automobiles.

Forest stakeholders agreed least strongly (<2.5), with the statement with <50% consensus:

- Businesses and industry should purchase, from their electricity provider, at least some renewable energy.

4.4 GOVERNMENT ACTIONS

Both water and forestry stakeholders preferred **federal** regulation to:

- Require reductions in CO2 and other air pollutants from power plants (65%; 75%).
- Increase funding for public transit (59%; 48%).
- Support development of renewable energy resources (50%; 41%).

Both water and forestry stakeholders preferred **state** regulation to:

- Purchase a percentage of renewable energy resources in the State energy mix (71%; 62.5%).
- Require energy efficient designs for new state buildings (68%; 61%).
- Provide technical assistance to business to make energy efficient modifications (48%; 48%).

Both water and forestry stakeholders preferred **local** regulation to:

- Design more walkable communities (67%; 38%).
- Encourage mixed-use development to reduce use of automobiles (50%; 41%).

Both stakeholder groups were evenly divided between **state** and **local** regulation to

- Encourage better planning to discourage urban sprawl development.

Water stakeholders preferred **federal** regulation as opposed to forestry stakeholders who preferred **state regulation** to:

- Develop financial incentives for business and industry to make energy efficient modifications.

Water stakeholders preferred **state** regulation as opposed to forestry stakeholders who evenly divided between **state** and **federal** regulation to:

- Provide rebates of registration fee for cleaner cars like hybrid vehicles or ones using natural gas (55%).

While water stakeholders preferred either **state or federal** regulation, forestry stakeholders preferred voluntary incentives to:

- Improve forest management practices to increase carbon sequestration.

5.0 CONCLUSIONS

Identifying the potential impacts from climate change in a meaningful way to stakeholders influences their perception of the significance of the problem. It is clear that the complexity of climate change is not completely communicated in the media and misconceptions are common. Stakeholders need relevant information to their particular sectors regarding climate change impacts.

Given the current lack of political support for the international Kyoto[3] climate treaty as well as mandatory regulation of greenhouse gases, it was significant that a majority of both water and forestry stakeholders supported the following actions in each sector for mitigating climate change including:

Individual Actions –

Water stakeholders agreed most with and reached strong consensus (>75%) on the statements:

- Individuals should consider fuel efficiency (mpg) when purchasing an automobile.
- Individuals should incorporate energy efficiency into construction or renovation/repair of one's home.
- Individuals should purchase energy efficient lighting and appliances.

Forestry stakeholders agreed most (>60%) with the statements:

- Individuals should incorporate energy efficiency into construction or renovation/repair of one's home.
- Individuals should purchase energy efficient lighting and appliances.
- Individuals should efforts to reduce sprawl.

Business and Industry Actions –

Both groups showed the greatest agreement with the following two statements with a high degree of consensus among water stakeholders (82% and 94%) and moderate consensus among forestry stakeholders (50% and 63%):

- Purchase energy efficient lighting and equipment.
- Consider fuel efficiency (mpg) when purchasing fleet automobiles.

Government Actions –

Both water and forestry stakeholders preferred **federal** regulation to:

- Require reductions in CO2 and other air pollutants from power plants (65% water stakeholder; 75% forestry stakeholders).

[3] For information on the Kyoto Protocol, see http://unfccc.int/cop7/convkp/index.html.

Both water and forestry stakeholders preferred **state** regulation to:

- Purchase a percentage of renewable energy resources in the State energy mix (71%; 62.5%).
- Require energy efficient designs for new state buildings (68%; 61%).

Additional research is needed to better assess the potential impacts of climate change at the regional and local level. Climatic models need to be applied at a more spatial level, and local and regional records of climatic patterns need to be collected and analyzed. Most importantly, this type of research needs to be brought to the public forum so that stakeholders have the information to make informed decisions.

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APPENDIX A
List of Participants:

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A-1 ALPHABETICAL LIST OF PARTICIPATING SCIENTISTS

First Name	Last Name	44 New Hampshire Forestry and Water Scientists, by Affiliation
John	Aber	UNH Complex Systems Research Center
Scott	Ashley	New Hampshire Department of Environmental Services
Matt	Ayres	Dartmouth College
Kim	Babbitt	University of NH
Tom	Ballestero	University of New Hampshire
David	Bartlett	UNH Earth Oceans Space
Alicia	Carlson	New Hampshire Department of Environmental Services
Lynne	Carter	National Assessment Coordination Office
Jody	Connor	New Hampshire Department of Environmental Services
Steve	Couture	New Hampshire Department of Environmental Services
Patrick	Crill	UNH Complex Systems Research Center
Chris	Eagar	USDA Forest Service
Robert	Estabrook	New Hampshire Department of Environmental Services
Tony	Federer	USDA Forest Service [retired]
Rich	Hallett	USDA Forest Service
Steve	Hamburg	Brown University
James	Haney	University of New Hampshire
Walter	Henderson	New Hampshire Department of Environmental Services
Bruce	Hill	Clean Air Task Force
Richard	Holmes	Dartmouth College
Jim	Hornbeck	USDA Forest Service
George	Hurtt	UNH Complex System Research Center
Lloyd	Irland	The Irland Group
Steve	Jones	Jackson Estuarine Laboratory
Barry	Keim	University of New Hampshire
William	Leak	USDA Forest Service
Adam	Markham	Clean Air Cool Planet
Debra	Meese	Cold Regions Research and Engineering Laboratory
Rakesh	Minocha	USDA Forest Service
Greg	Norris	Economist
David	Publicover	Appalachian Mountain Club
Ken	Rancourt	Mount Washington Observatory
Barrett	Rock	UNH Complex Systems Research Center
Jeff	Schloss	University of New Hampshire
Walter	Shortle	USDA Forest Service
Amy	Smagula	New Hampshire Department of Environmental Services
Lori	Sommer	New Hampshire Department of Environmental Services
Robert	Talbot	UNH Complex Systems Research Center
Dave	Thurlow	Cumulus Interactive
Cameron	Wake	University of New Hampshire
Hal	Walker	US Environmental Protection Agency
Kenneth	Warren	New Hampshire Department of Environmental Services
Steve	Winnett	US EPA Region I
Mariko	Yamasaki	USDA Forest Service

A-2 LIST OF PARTICIPATING STAKEHOLDERS

First Name	Last Name	STAKEHOLDERS—SORTED BY ORGANIZATION	water	forest
Iain	MacLeod	Audubon Society of New Hampshire	x	
Ann	Friend	Audubon Society of New Hampshire; Nottingham CC	x	
Doug	Bogen	Clean Water Action	x	
Lorie	Chase	Cocheco River Watershed Coalition	x	
Ilya	Karnauk	Concord High School	x	
Nancy	Girard	Conservation Law Foundation		x
Carol	Foss	Consulting Biologist		x
Ned	Eldridge	EcoLogging; Peterborough Conservation Commission		x
Shaun	Lagueux	FORECO		x
Van	Webb	Harding Hill Farm		x
Don	Winsor	HHP, Inc.		x
Robert	Wood	Lake Sunapee Protective Association	x	
Judith	Spang	Lamprey River Advisory Committee	x	
Ethan	Howard	Manchester Water Works	x	
Bill	Altenburg	Mountain Recreation Corp		x
Margaret	Watkins	National Park Service	x	
Marge	Swope	New Hampshire Association of Conservation Commissions	x	
John	Hodsdon	New Hampshire Association of Conservation Districts	x	
James	Gallagher	New Hampshire Department of Environmental Services	x	
Paul	Currier	New Hampshire Department of Environmental Services	x	
John	Dreisig	New Hampshire Department of Health and Human Services	x	
Nancy	Christie	New Hampshire Lakes Association	x	
Paul	Hartgen	New Hampshire Lodging and Restaurant Association	x	
Bill	Eva	New Hampshire Maple Producers Association		x
Jasen	Stock	New Hampshire Timberland Owners Association		x
Philip	Bryce	New HampshireDRED Division of Forests and Lands		x
Johanna	Lyons	New HampshireDRED Division of Parks and Recreation		x
Rick	Demark	North Country RC & D: New Hampshire Travel Council		x
Catherine	Corkery	Sierra Club-New Hampshire		x
Sarah	Thorne	Society for the Protection of New Hampshire Forests		x
Swift	Corwin Jr.	Society of American Foresters-Granite State		x
Chris	Devine	Squam Lakes Association	x	
Mark	Zankel	The Nature Conservancy		x
Ralph	Arnold	TIMCO		x
Tom	Chrisenton	Tree Farmer		x
Northam	Parr	UNH Cooperative Extension		x
Edwin	Robinson	Upper Merrimack River LAC	x	
Steve	Fay	USFS White Mountain National Forest		x
			(18)	(20)

A-3 NEW HAMPSHIRE CLIMATE CHANGE LOCAL IMPACT ASSESSMENT PROJECT (LIAP) WORK TEAM MEMBERS

New Hampshire Department of Environmental Services

Kenneth A. Colburn, former Director Air Resources Division

Joanne O. Morin, Air Resources Division

LIAP Consultant Team

Charles Levesque, Innovative Natural Resource Solutions

Katherine Hartnett, The Jordan Institute/New Hampshire Min. Impact Dev. Partnership

Carol Foss, Consulting Biologist

Michele Tremblay, NatureSource Communications

Barrett Rock Ph.D., UNH Complex System Research Center

Lisa Shapiro, Ph.D., Economist, Gallagher, Callahan, Gartrell, P.A.

Heidi Kroll, Gallagher, Callahan, Gartrell, P.A.

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APPENIX B

Chronology of the New Hampshire Climate Change Local Impact Assessment Project (LIAP)

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MEETING PARTICIPANTS, GOALS, AND PRODUCTS

DATE	PARTICIPANTS	PHASE/GOALS
8 Jan 2001	New Hampshire forestry and water scientists	**Phase 2** • To assemble science-based information about relevant local impacts of climate change on New Hampshire forests and water for decision-makers. • To review and comment on the draft NERA findings, chapters, format, and information gaps.
1 Feb 2001	New Hampshire water scientists	• To increase technical input into analysis of water issues
15/23 Feb 2001	New Hampshire water scientists at New Hampshire Department of Environmental Services	• To provide a consensus-based analysis of relevant water issues
May, 2001	Phase 2 Products	• Revised initial forestry and water issues list, by degree of consensus on likelihood. • Scientific consensus papers on likelihood of effects of global climate change on key New Hampshire forestry and water issues • Summary of current relevant economic statistics
25 May 2001	New Hampshire forestry and water stakeholders	**Phase 3** • To convey the current extent of scientific consensus and areas of agreement and disagreement on climate variability and change at the global, national, regional, and New Hampshire state scales; • To ascertain from key stakeholders their impressions of what the ramifications of the current scientific consensus mean for New Hampshire water and forests; • To solicit suggestions about possible actions that business, individuals, and government could, or should, undertake to address climate variability and change.
Dec, 2001	Phase 3 Products	• Forestry and Water Stakeholder Survey & analysis • Final LIAP project report

CHRONOLOGY OF NEW HAMPSHIRE CLIMATE CHANGE LOCAL IMPACT ASSESSMENT PROJECT (LIAP)

- **1999** New Hampshire Department of Environmental Services Request For Proposal and contract
- **Spring, 2000** Initial LIAP climate change brief by Dr. Rockwell
- **Late Spring, 2000** Identify and recruit forestry and water scientists working in New Hampshire, and representative group of New Hampshire water and forestry stakeholders
- **Early Summer, 2000** Decision to use New England Regional Assessment (NERA) as science source
- **Fall, 2000** Draft NERA published for peer-review
- **Dec, 2000** Mail out National Assessment, draft NERA, and Environmental Defense Fund report to forestry and water scientists, with initial list of current climate change related issues complied from recent scientific reports
- **8 Jan 2001** New Hampshire Forum for Forestry and Water Scientists
- **1 Feb 2001** New Hampshire Forum for Water Scientists
- **15/23 Feb 2001** New Hampshire Forum for Water Scientists at New Hampshire Department of Environmental. Services
- **27 Mar 2001** Revised key issues list and draft Forestry and Water assessments mailed out to participating scientists
- **16 April 2001** Scientists comments on revised key issues list and draft assessments due
- **10 May 2001** Mail out IPCC Third Assessment Report Summary, National Assessment excerpt, NERA overview, Key Issues List, New Hampshire scientists forestry and water issues assessment summaries, along with meeting goals and groundrules
- **17 May 2001** Mail out summary of current economic statistics on certain economic sectors associated with potential New Hampshire forestry and water impacts, and revised NERA Overview
- **25 May 2001** Forestry and Water Stakeholder Meeting
- **July 2002 Final report reviewed by scientists ands stakeholders, and published**

APPENDIX C

"How Will the New England Region be Affected by Climate Change"

Taken from *The New England Regional Assessment (NERA)* September 2001

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How Will the New England Region be Affected by Climate Change?

Records of regional temperatures and rainfall show that t has warmed since 1895, according to the August 2001 re England Regional Assessment of Potential Climate Varia

Overall, New England and upstate New York have warmed by 0.7º F, yet some states (RI, NH) have warmed by two to three times the regional average. One state (ME) has cooled. Warming in winter months has been greater than summer-time warming. The milder winters, earlier maple sap flows, earlier dates for ice melting on lakes, and reduced snowfall recently experienced across the New England region are all likely responses to this increase in temperature.

Human activities are affecting climate. There is now strong scientific evidence and consensus that much of the global warming experienced in the last half of the 20th century is attributable to human factors.

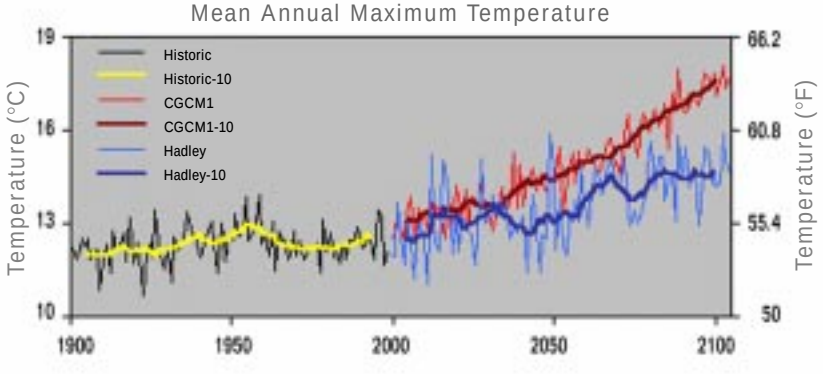
Temperature changes* in the region between 1895 and 1999 indicate that regional climate in general is warming. The opposite historic temperature patterns in Maine and New Hampshire may be due to differing land use practices or proximity to the ocean.

*The temperature values above are area weighted.

▶ Significant warming of 6-10º F projected over the next century. Two respected climate models project significant warming and an increase in precipitation for the New England Region. The Hadley Model projects a warming of 6º F in annual minimum temperatures and a 30% increase in precipitation for the region, while the Canadian Model projects a 10º F warming in minimum temperatures and a 10% precipitation increase over the next century. Either temperature increase would be greater than any climatic variation experienced in the region in the past 10,000 years. If either scenario occurs, the climate of the New England Region will be profoundly different than the climate of today.

If 6º F are added to Boston's 30-year (1961-1990) average temperature, the resulting temperature is approximately the 30-year average for Richmond, VA. If 10º F are added to Boston's 30-year average, the 30-year average for Atlanta, GA is the result.

New England Regionalized Historic and Scenario Mean Annual Maximum Temperature



▶ Regional air quality will worsen. If the climate becomes hotter and wetter, and automobile and power plant emissions remain the same or increase, regional air quality and acid rain problems will become worse in the future. Hotter temperatures increase the formation of smog and sulfate haze, and water vapor combines with compounds from automobile exhaust and power plant emissions to produce acid rain.

Risks to human health will significantly increase. Not only will our health be affected by increased levels of air pollution, but warmer winters can facilitate the expansion of Lyme disease-carrying tick populations and other disease vectors in the region.

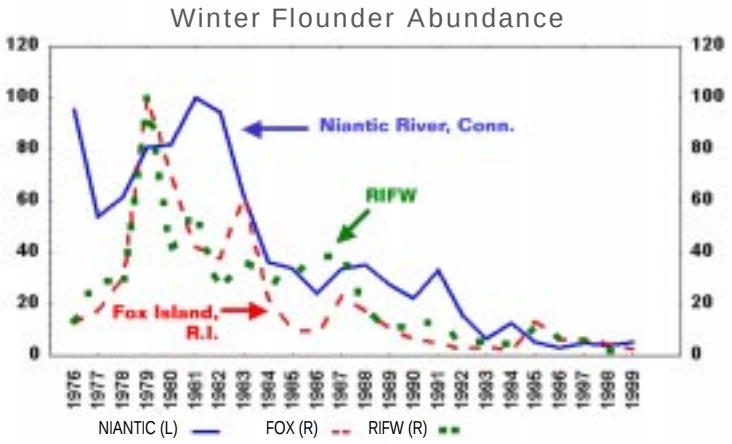
The New England natural environment will be altered. New England forests are already under stress. Warm temperatures allow insects and tree diseases to flourish and permit the introduction of exotic plant species. Potential droughts or flooding projected by models will have profound impacts on regional water availability and quality, and warming coastal waters will cause species shifts and toxic algal blooms. Sea-level rise could become a significant problem for low-lying coastal regions, affecting human infrastructure, beaches and coastal wetlands.

Maple syrup producers in the region are concerned about the regional decline in sugar maple health as syrup production shifts from New England to Quebec.

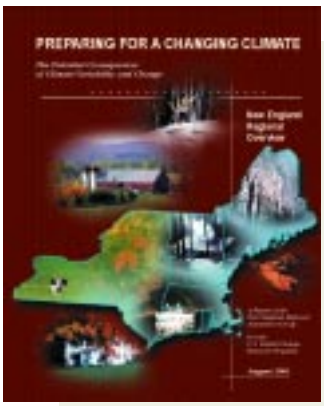
The impacts of climate change on the regional economy will vary and be significant. An assessment of some of the major regional industries shows that economic impacts are likely to be greatest on the human health sector, moderate on tourism and least severe on the natural resources sector due to the resiliency of the forest industry to projected changes.

What can we do? Win-Win Strategies

New England decision and policy makers have several options to reduce or eliminate potentially adverse impacts while offering other benefits, such as cleaner air and a stronger regional economy. These actions include promoting the use of forests to absorb and store carbon dioxide, reducing regional air pollution by reducing emissions from automobiles and power plants, developing highly efficient energy sources, and investing in "green technologies."



Winter flounder has experienced an obvious decline over the past 25 years, which can be mainly attributed to a combinaton of fishing pressure and warmer water temperatures.



Learn more about the results of the New England Regional Assessment and strategies for reducing potentially adverse impacts by reading **Preparing for a Changing Climate: The Potential Consequences of Climate Variability and Change**. *This report was prepared for the U.S. Global Change Research Program and is the product of a four-year effort to characterize the impacts of climate change on the New England Region. Over 300 stakeholders, representing a broad range of interests, participated in the NERA effort. Copies may be obtained by contacting Faith Sheridan at faith.sheridan@unh.edu or at 603-862-1792.*
The report is also available online at www.necci.sr.unh.edu.

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APPENDIX D

Issue Papers: Impacts to New Hampshire Forestry and Water Resources

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ISSUE: Maple syrup production

DESCRIPTION: Maple syrup production here refers to commercial production of products from maple sap.

LIKELIHOOD AND DIRECTION OF POTENTIAL CHANGE: Most participating forest scientists expected climate change to reduce maple syrup production above and beyond decreases resulting from current social and economic factors.

RATIONALE: Increased winter temperatures would reduce the duration of sap flow and warmer, drier growing seasons ultimately would reduce the distribution of sugar maple.

ISSUE: Vector borne diseases

DESCRIPTION: Vector borne diseases of concern include Lyme disease, eastern equine encephalitis, and other human diseases transmitted by mosquitoes and ticks to which forest workers and recreationists risk exposure.

LIKELIHOOD AND DIRECTION OF POTENTIAL CHANGE: Participating forest scientists generally agreed that climate change would increase the incidence of vector-borne diseases.

RATIONALE: Warmer temperatures are likely to result both in northward expansions and population increases of vectors, and in population increases of host wildlife species (e.g., deer).

ISSUE: Wildlife

DESCRIPTION: This issue includes the distributions of particular wildlife species within the state of New Hampshire, and the wildlife species compositions at particular locations within the state.

LIKELIHOOD AND DIRECTION OF POTENTIAL CHANGE: Forest scientists agreed that climate change would result in shifts of wildlife distributions and species compositions, in addition to those resulting from changing land use patterns and an increasingly fragmented and developed landscape.

RATIONALE: Increased temperatures will enable some wildlife species to inhabit areas further north and at higher elevations. In addition, vegetation shifts resulting from climate change will change habitat availability for habitat specialist species.

ISSUE: Forest Productivity

DESCRIPTION: Forest productivity refers to net productivity, or accumulation of matter and energy as biomass.

LIKELIHOOD AND DIRECTION OF POTENTIAL CHANGE: The majority of participating forest scientists expected that climate change could result in a short-term increase in forest productivity.

RATIONALE: Many scientists expect climate change to result in a longer growing season, warmer temperatures during the growing season, higher water use efficiency, and fertilization from increased carbon dioxide, all of which would lead to increased productivity. Deleterious effects from air pollution, diseases and insects, and water stress may temper such increases.

Warmer temperatures can contribute to increased ozone levels. Forest health effects of ground-level ozone pollution include breakdown of cell and chloroplast membranes, which results in cell degradation and chlorophyll loss, and ultimately in reduced growth and productivity. Stress resulting from climate change could increase disease and insect vulnerability of species poorly adapted to the new climatic conditions. In addition, more southern insects and pathogens that do not currently occur here could extend their range northward into New Hampshire.

Participating forest scientists evaluated eight climate-related factors that can affect forest productivity. The majority anticipated that of these, ground-level ozone production and forest insects and pathogens are most likely to have significant effects. They were uncertain about the likelihood of effects from changes in soil moisture, ice damage, bud mortality from freeze-thaw cycles, and considered the likelihood of effects from changes in erosion and leaching, forest fires, and freezing injury to roots to be low.

ISSUE: Tree species composition and forest type distribution

DESCRIPTION: This issue constitutes the geographic distributions and extents of the major forest types that currently comprise New Hampshire forests: spruce-fir, beech-birch-maple, oak-pine-hemlock, and oak-hickory.

LIKELIHOOD AND DIRECTION OF POTENTIAL CHANGE: Increasing temperatures will result in some northward migration of some tree species. Since vegetation adjusts to climate change with a considerable lag time, major geographic shifts are unlikely during a 100-year period. The majority of participating forest scientists expected that climate change is likely to reduce (but not eliminate) the distributions of the spruce-fir and beech-birch-maple types, increase the distribution of the oak-pine-hemlock type, and either increase or decrease the distribution of the oak-hickory type.

RATIONALE: Warmer temperatures and increasing freeze-thaw cycles would reduce spruce and fir competitiveness and survival in the southern parts of their current range. Scientists expect yellow birch and sugar maple to migrate northward in the event of climate change, as warmer, drier conditions would give beech, oaks, and pines a competitive advantage. Warmer temperatures and more intense and sporadic precipitation events in areas currently occupied by beech-birch-maple (and possibly some areas of spruce-fir) would favor the oaks and pines. Warmer, more humid conditions could enable hickory to expand its range northward. Warmer, drier conditions could bring northward expansion on moist soils, but could result in decreased distribution within some of the current range.

ISSUE: Fall foliage

DESCRIPTION: Fall foliage refers to the diversity, intensity, and synchronicity of fall leaf color.

LIKELIHOOD AND DIRECTION OF POTENTIAL CHANGE: Participating forest scientists held differing opinions regarding the potential effects of climate change on fall foliage.

RATIONALE: Climate-related factors potentially acting to reduce fall foliage include drought stress in late summer from warmer, drier conditions, decreased abundance of white birch and sugar maple, and increased abundance of oak and beech. Participating scientists disagreed on the likely severity of these effects. An increase in the abundance of red maple would tend to mitigate these changes.

In the event of climate change, warmer, more humid conditions could enable hickory to expand its range northward. Warmer, drier conditions could bring northward expansion on soils with adequate moisture, but also could result in decreased distribution within some of the current range.

ISSUE: Flooding

DESCRIPTION: Flooding refers to the temporary inundation of low-lying lands.

LIKELIHOOD OF CHANGE: Wetland scientists expect that climate change would be very likely to increase the frequency of flooding events.

RATIONALE: Scientists anticipate an increase in flooding potential if rain events occur in short and very intense cycles. The extent of flooding would depend on time of year and intensity of the events. Short duration, high intensity rain events preclude opportunities for groundwater infiltration, and result in rapid flushing of water over land. Hot dry periods between storm events would increase flooding because excessively dry soils have poor percolation/infiltration rates. In addition, heavy rains on frozen ground could increase the likelihood of winter flooding. A reduced snow pack could generate less flooding during spring run-off. The result could be a major change in the seasonal timing of flood events, and thus on their impacts on floodplain ecosystems.

ISSUE: Snow Depth/Pack/Duration

DESCRIPTION: Snow depth is the depth of snow on the ground at any given time. Snowpack is normally defined by the snowwater equivalent, or depth of meltwater. Snow duration is the duration of continuous snow cover.

LIKELIHOOD OF CHANGE: Scientists expect that climate change is very likely to result in a substantial decrease in snow depth, pack, and duration.

RATIONALE: Warmer temperatures will reduce snowpack both because more winter precipitation will be in the form of rain and because snow will melt faster. Both the depth and the duration of snow cover are significantly decreased by only a degree or two of warming. The incidence of low-snow winters has already increased and will increase further, with adverse effects on skiing, snowshoeing, and snowmobiling. Considerably stream flow will be shifted from March-April to mid-winter months, with consequences for water management and ecology.

ISSUE: Erosion, sedimentation, and pollution loads

DESCRIPTION: This issue includes transportation of soil from terrestrial to aquatic environments and chemical inputs to lakes and rivers.

LIKELIHOOD OF CHANGE: Scientists expect climate change to increase erosion, sedimentation, and pollution loads beyond increases resulting from increasing developments and impervious surfaces.

RATIONALE: Higher intensity storm events would increase the energy of water running over the land, thereby increasing sheet erosion of unvegetated areas. This will increase sedimentation and flushing of accumulated contaminants into lakes, ponds, and wetlands. Longer spacing between storm events would allow greater accumulation of pollutants in the watershed, increasing the impact of the 'pollutant plug' to the waterbody. (More frequent, smaller events would move less concentrated pollutant loads.) Increased stream flow during high intensity storms also would increase bank erosion and channel dynamics.

ISSUE: Harmful algae blooms in freshwater systems

DESCRIPTION: Harmful algae blooms encompasses the frequency and duration of aquatic algae proliferations that deplete oxygen in a water body and lead to mortality of other organisms, and proliferations of toxin-producing algae.

LIKELIHOOD OF CHANGE: Participating scientists anticipate that climate change may result in more frequency and longer lasting harmful algae blooms in freshwater lakes.

RATIONALE: Harmful algal blooms could increase due to increases in nutrient loading and changes in ice cover. Warmer water temperatures and increased run-off will provide good conditions for algal dominance. Warmer waters also decrease dissolved oxygen capacity, potentially increasing the effects of lower algal concentrations.

ISSUE: Cold water fisheries

Description: Cold water fisheries include salmon and trout, which require cold, highly oxygenated water for their survival.

LIKELIHOOD OF CHANGE: Scientists expect climate change to result in a substantial decrease in cold water fisheries.

RATIONALE: Warmer water temperatures will reduce suitable habitat for coldwater fish. Increased runoff would cause greater nutrient loading, stimulating algal growth and further reducing dissolved oxygen, even in deeper, colder waters. Increased sedimentation can destroy habitat for forage fish, smother eggs, and clog gills.

ISSUE: Warm water fisheries

DESCRIPTION: Warm water fisheries include bass, perch, pickerel, sunfish, hornpout, and other species that can survive in relatively warm, oxygen-poor waters.

LIKELIHOOD OF CHANGE: Scientists expect climate change to result in a substantial increase in warm water fisheries.

RATIONALE: Increased temperatures will reduce the extent of coldwater habitat and increase that of warm water habitat.

ISSUE: Shellfish resources

DESCRIPTION: Shellfish resources include mollusks and crustaceans harvested for food in coastal and estuarine waters.

LIKELIHOOD OF CHANGE: Sicentists expect climate change to result in a substantial decrease in shellfish resources.

RATIONALE: Increased frequency of high volume rainfall events will decrease salinity of coastal and estuarine waters, and have negative effects on shellfish resources. Higher temperatures also mayu induce shifts in species composition of bottom-dwelling organisms.

ISSUE: Drinking waster supplies

DESCRIPTION: This issue encompasses potability and adequate supply of drinking water from both surface and groundwater sources.

LIKELIHOOD AND DIRECTION OF CHANGE: Participating scientists expect that climate change will lead to a substantial decrease in drinking water supplies.

RATIONALE: Increased runoff could reduce the amount of available groundwater and reduce the quality of surface water, requiring a shift from groundwater to surface sources and more extensive treatment. Independent of climate change, increasing demands and increased non-point source pollution resulting from widespread development could reduce both quality and quantity of available drinking water.

ISSUE: Salt water incursions

DESCRIPTION:: Salt water incursions refer to salt water infiltration of previously freshwater aquifers in coastal areas.

LIKELIHOOD AND DIRECTION OF CHANGE: Scientists expect climate change to result in a substantial increase in salt water incursions.

RATIONALE: Rising sea level resulting from climate change could increase the incidence of salt water incursions into groundwater sources in the coastal zone. Increased demands on groundwater in this rapidly growing region could have the same effect independent climate change.

ISSUE: Water-borne diseases

DESCRIPTION: Water-borne diseases include illnesses caused by bacteria, viruses, or parasites that are transmitted by contaminated water.

LIKELIHOOD OF CHANGE: Scientists expect climate change to cause a substantial increase in water borne diseases.

RATIONALE: Warmer waters encourage the viability and proliferation of disease organisms. Increases in water levels resulting from intense storm events and more flooding could cause septic system failures that, lead to increased pathogens in water bodies.

ISSUE: Surface water quality

DESCRIPTION: This issue encompasses the ability of surface waters to support communities of aquatic organisms that require clean water, and the suitability of surface waters for swimming and boating.

LIKELIHOOD OF CHANGE: Scientists expect climate change to cause a decrease in surface water quality.

RATIONALE: Warmer temperatures and increased runoff are likely to increase sedimentation, pollution loads, and algal blooms.

ISSUE: Non-native species

DESCRIPTION: Non-native species include invasive plants and animals that occupy wetlands or water bodies and that have been introduced to the northeast from other parts of the world. Current species of concern include zebra mussel, milfoil, *Phragmites*, and purple loosestrife.

LIKELIHOOD OF CHANGE: Scientists expect climate change to increase the distribution and abundance of non-native species.

RATIONALE: Increases in temperature and potential extensions of the growing season could enable invasive species to extend their ranges, and the numerous species that are nuisances further south could become able to survive in this region.

ISSUE: Droughts

DESCRIPTION: Droughts are period with little or no precipitation that are of sufficient duration to reduce plant growth and productivity.

LIKELIHOOD OF CHANGE: Scientists believe that climate change may have little effect on, or possibly increase the frequency of droughts.

RATIONALE: Increasing climate variability and greater frequency of extreme events could increase droughts. If a greater proportion of annual precipitation occurs in intense storms, run-off will increase at the expense of infiltration. If variability increases, there could be longer periods between precipitation events.

ISSUE: Algal productivity

DESCRIPTION: Algal productivity refers the accumulation of biomass by aquatic algae.

LIKELIHOOD OF CHANGE: Participating scientists expected climate change to result in some increase in algal productivity.

RATIONALE: Increased pollutant loads and warmer temperatures are likely to increase algal productivity. In addition, changes in weather patterns could alter nutrient fluctuations in water bodies, and milder winters could effect ice thickness and increase the duration of open water, which would lead to changes in seasonal succession and total annual productivity.

ISSUE: Wetlands

DESCRIPTION: Wetlands include areas of permanent or seasonal inundation, and sites with poorly drained or very poorly drained soils.

LIKELIHOOD AND DIRECTION OF POTENTIAL CHANGE: There is considerable uncertainty regarding the direction and likelihood of potential change.

RATIONALE: Climate change has the potential to modify sizes, types, and values of wetlands. Changes in precipitation patterns could result in either greater or lesser amounts of water accumulating in wetlands. Warmer temperatures may change evapotranspiration rates, and altered water regimes may lead to changes in wetland vegetation. If precipitation events become more intense and infrequent, water levels in wetlands may fluctuate dramatically during the growing season. An overall increase in precipitation could increase the size and number of wetlands through groundwater discharge and surface water runoff. Increases in winter precipitation could increase numbers of vernal pools.

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APPENDIX E

Summary of Economic Statistics on Certain Economic Sectors associated with Potential Forestry and Water Impacts

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ECONOMIC STATISTICS ON FORESTRY AND WATER ISSUES
New Hampshire Climate Change Local Impact Assessment Project
May 2001

Overview

As part of the New Hampshire Climate Change Local Impact Assessment Project (LIAP), scientists assessed the potential impacts on our forestry and water resources that may result from climate change. These potential impacts affect various economic sectors such as tourism, forest-based manufacturing, municipal and state infrastructure, and fisheries. Gallagher, Callahan & Gartrell gathered existing economic statistics on the economic sectors associated with potential water and forest impacts. The following table provides summary statistics for industries and issues identified by the participating scientists. It is important to note that no original research or studies were conducted, nor was modeling performed to generate new economic data. The data reported is strictly from readily available sources. These statistics are for informational purposes only to provide a general economic context to consider potential forestry and water impacts from climate change. These data do not reflect estimates of the specific economic impacts that may occur as a result of climate change, or imply that potential economic impacts could be positive or negative.

To help provide some context to the numbers in this table, some additional aggregate figures include: New Hampshire's total gross state product (GSP) in 1998 was $41.3 billion. Total gross direct income in New Hampshire attributed to open space was $3.6 billion 1997, according to a Resource Systems Group January 1999 study, with the total direct and indirect gross income estimated at $8.2 billion. Total direct spending by travelers is reported at 8.4% of New Hampshire's GSP, according to a recent economic development report by the Governor's Office.

Issue	Summary Economic Statistics Annual New Hampshire Data Unless Otherwise Noted	Data Source
Forestry Issues:		
Maple syrup	$2.7 million in commercial sales	1998 data from *The Economic Importance of New Hampshire's Forests,* North East State Foresters Association, March 2001, at pg. 6.
Vector-borne disease	Vector-borne disease-specific data for New Hampshire not readily available. United States: $21,000 in total case costs for transiently infected individuals $3 million in total case costs for severely infected individuals	1998 data from the *US Centers for Disease Control and Prevention, Division of Vector-Borne Infectious Diseases Fact Sheets* on various forms of Encephalitis (Arboviral, Eastern Equine, Western Equine, LaCrosse, and St. Louis).
Wildlife	$66 million in direct hunting expenditures (trip, equipment, and other) $281 million in direct wildlife-watching expenditures (trip, equipment except special equipment, and other) $132 million in indirect and induced effects from direct wildlife-watching expenditures, resulting in $91 million in wages and salaries	1996 data from *The 1996 National Survey of Fishing, Hunting and Wildlife-Associated Recreation - New Hampshire*, U.S. Fish & Wildlife Service," Table 19 at pg. 30. 1996 data from *The 1996 National and State Economic Impacts of Wildlife Watching - Based on the 1996 National Survey of Fishing, Hunting and Wildlife-Associated Recreation,* US Fish & Wildlife Service, Table 3 at pg. 8.

Issue	Summary Economic Statistics Annual New Hampshire Data Unless Otherwise Noted	Data Source
Forest Productivity	$1.5 billion in forest-based manufacturing value of shipments $509 million in revenues generated by forest-based recreation and activities $344 million in payroll (manufacturing and recreation) $169 million in revenue from roundwood and stumpage $51 million in sales of wood fuel $6 million in sales of Christmas trees and wreaths $4 million in timber tax	1998 data from *The Economic Importance of New Hampshire's Forests,* North East State Foresters Association, March 2001, at pg. 6. Forest Types in New Hampshire (1997) northern hardwood - 49% white / red pine - 17% oak / hickory - 13% spruce / fir - 9% aspen / birch - 6% other - 6%
Fall foliage	Fall foliage-specific data for New Hampshire not readily available.$509 million in revenues from forest-related recreation and tourism in 1997.$888 million in direct spending on travel and tourism during September through November 2000.	1998 data from The Economic Importance of New Hampshire's Forests, North East State Foresters Association, March 2001, at pg. 1.2000 data from *New Hampshire Barometer for Fall 2000 (September, October, and November),* The Institute for New Hampshire Studies, Plymouth State College, 2000.

Issue	Summary Economic Statistics Annual New Hampshire Data Unless Otherwise Noted	Data Source
Water Issues:		
Wetlands	Not Readily Available	
Flooding	$7.59 million average annual cost based on data from 1955-1975 and 1983-1999 $534 million in flood insurance coverage (not premiums).	1999 data from *The Extreme Weather Sourcebook 2001,* National Center for Atmospheric Research's Environmental and Societal Impacts Group in partnership with the Atmospheric Policy Program of the American Meteorological Society, 2001. Verbal correspondence on 5/15/01 with George Musler, New Hampshire Office of Emergency Management.
Snow pack/depth	Snow pack/depth-specific data for New Hampshire not readily available. $566 million in direct and indirect spending during all seasons attributable to the ski industry, $209 million of which was in direct spending during ski season $181 million in annual payroll due to direct and indirect spending during all seasons attributable to the ski industry $58 million in state and local tax receipts due to direct and indirect spending (excluding FICA, workers' compensation, and federal taxes) $87 million in improvements at New Hampshire ski areas during 1990-2000	1999/2000 data from *The New Hampshire Ski Industry, 1999-2000: Its Contribution to the State's Economy*, prepared for Ski New Hampshire by The Institute for New Hampshire Studies, Plymouth State College, February 2001, at pgs. E1-E2.

Issue	**Summary Economic Statistics Annual New Hampshire Data Unless Otherwise Noted**	**Data Source**
Droughts	Drought-specific data for New Hampshire not readily available. $68 million in total Gross State Product from the farm industry.	1998 data from *The US Department of Commerce's Bureau of Economic Analysis, Regional Accounts data*, www.bea.doc.gov/bea/regional/gsp.
Erosion, sedimentation, & pollution loads	Erosion, sedimentation, & pollution loads-specific data for New Hampshire not readily available. Sea level has risen 7 inches in the last 100 years; $39-$304 million estimated for coastal sand replenishment to counter a 20-inch sea level rise, if such a rise should occur. Maine: A 1.37 meter increase in lake clarity would bring $25 million in new money into Maine and increase net economic values by $2 billion.	1997 data from *Climate Change and New Hampshire*, US Environmental Protection Agency, Office of Policy, Planning and Evaluation, EPA 230-F-97-008cc, September 1997, www.epa.gov/globalwarming/impacts/stateimp/newhampshire/index.html.1996 data from *Great Ponds Play an Integral Role in Maine's Economy,* Kevin Boyle et al., April 1997, at pgs. 37-43.
Algal productivity	Not Readily Available	
Harmful algal blooms in freshwater	Not Readily Available	

Issue	Summary Economic Statistics Annual New Hampshire Data Unless Otherwise Noted	Data Source
Cold water fisheries	Cold water fisheries-specific data for New Hampshire not readily available. $320 million in direct sport fishing expenditures (trip, equipment, and other) $260 million in indirect and induced effects from direct sport fishing expenditures	1996 data from *The 1996 Economic Impact of Sport Fishing in the United States,* American Sports Fishing Association, Appendix B.
Warm water fisheries	Warm water fisheries-specific data for New Hampshire not readily available. $320 million in direct sport fishing expenditures (trip, equipment, and other) $260 million in indirect and induced effects from direct sport fishing expenditures	1996 data from *The 1996 Economic Impact of Sport Fishing in the United States,* American Sports Fishing Association, Appendix B.
Shellfish	Not Readily Available	

Issue	**Summary Economic Statistics Annual New Hampshire Data Unless Otherwise Noted**	**Data Source**
Drinking water supplies	$278 average annual cost per residential water service from large public water systems (serving 500+ customers), based on usage of 275 gallons per day per single family home. Maine: $320 million in annual operating revenues for public water utilities in Maine $4 per year per lake residence drawing potable water from lakes to replace or maintain private water systems.	1998 data from "1998 Water Rate Survey, Large Water Systems," New Hampshire Department of Environmental Services, Environmental Fact Sheet WD-WSEB-16-5, 1999.1996 data from *Great Ponds Play an Integral Role in Maine's Economy*, Kevin Boyle et al., April 1997, at pg. 26.
Salt water incursions	Not Readily Available	
Water-borne disease	Water-borne disease-specific data for New Hampshire not readily available. $2.4 billion in Gross State Product from health services, or 6% of total Gross State Product $2.0 billion in employee compensation, or 9% of total employee compensation	1998 data from *The US Department of Commerce's Bureau of Economic Analysis, Regional Accounts data*, www.bea.doc.gov/bea/regional/gsp.
Non-native species	Not Readily Available	

Issue	Summary Economic Statistics Annual New Hampshire Data Unless Otherwise Noted	Data Source
Surface water quality	Surface water quality-specific data for New Hampshire not readily available. Maine: $1.8 billion in direct sales and $1 billion in indirect sales per year due to recreational and non-recreational uses of Maine's lakes; $6.7 billion in total net economic value per year due to recreational and non-recreational uses of Maine's lakes.	1996 data from *Great Ponds Play an Integral Role in Maine's Economy*, Kevin Boyle et al., April 1997, at pg. 35.

APPENDIX F

Stakeholder Survey
Tabulated Results, and Graphs of Responses

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MEASURING STAKEHOLDER CONSENSUS

Statement	Agreement (Rank) Forest	Agreement (Rank) Water	Consensus (%) Forest	Consensus (%) Water
1. I have a good understanding of the science of climate change.	1.7 (8)	2.3 (8)	57.1	47.1
2. Climate change is occurring as a result of global warming of surface temperatures.	2.3 (5)	3.1 (7)	47.4	50.0
3. Local impacts are probably already occurring from climate change.	2.6 (4)	3.8 (6)	35.0	47.0
4. Local impacts are going to be more evident in the next 5-10 years.	2.0 (6.5)	4.0 (4)	44.4	56.2
5. Human activities are the predominant cause of increased concentrations of greenhouse gases leading to climate change.	3.6 (1)	3.9 (5)	52.6	52.9
6. Individuals should take action in the area of climate change.	3.1 (2)	4.5 (3)	42.8	76.5
7. Industrial and commercial businesses should take action in the area of climate change	2.9 (3)	4.6 (1.5)	40.0	82.3
8. Non-government organizations, such as environmental groups, should take action in the area of climate change.	2.0 (6.5)	4.6 (1.5)	30.0	82.3

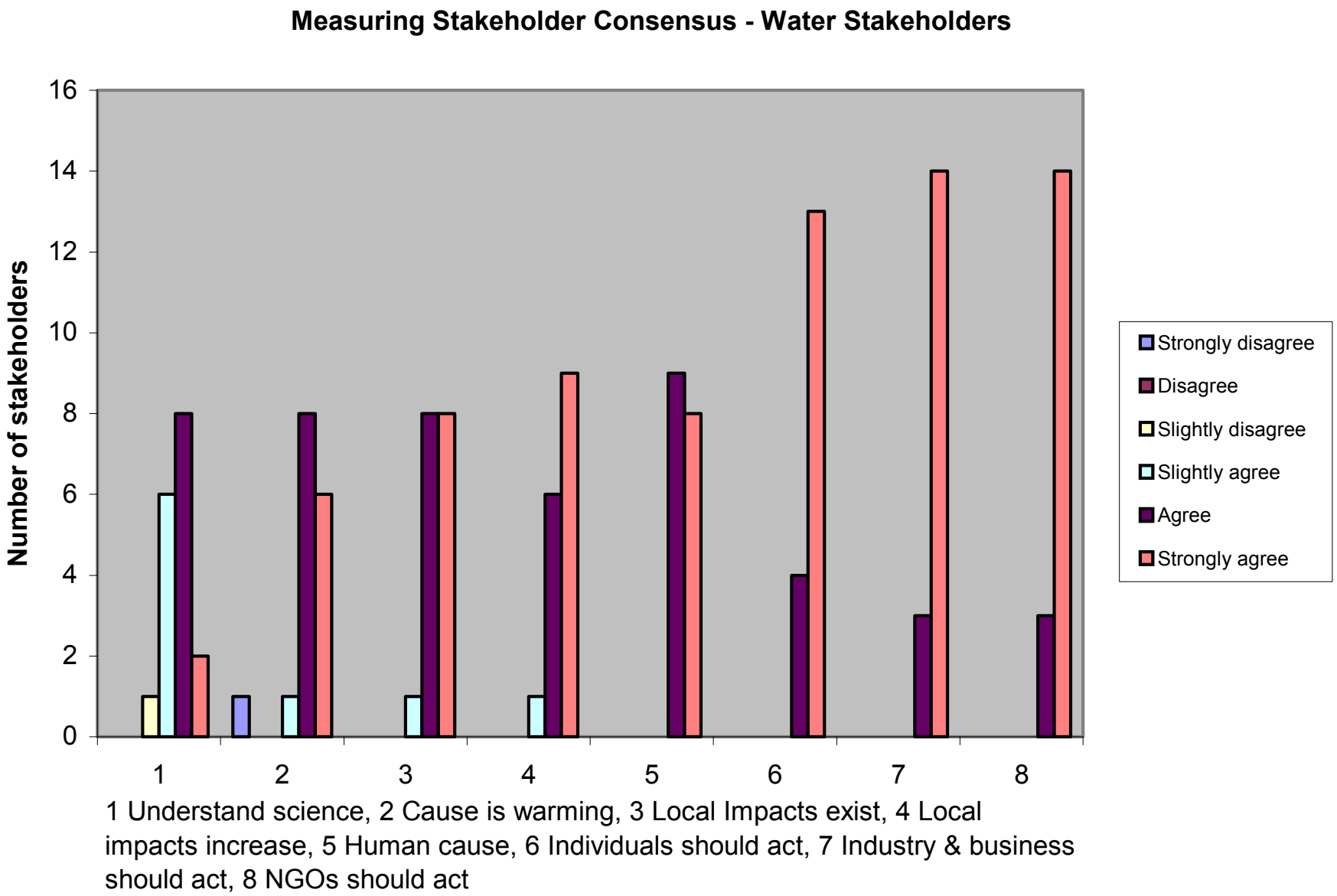
INDIVIDUALS ACTIONS

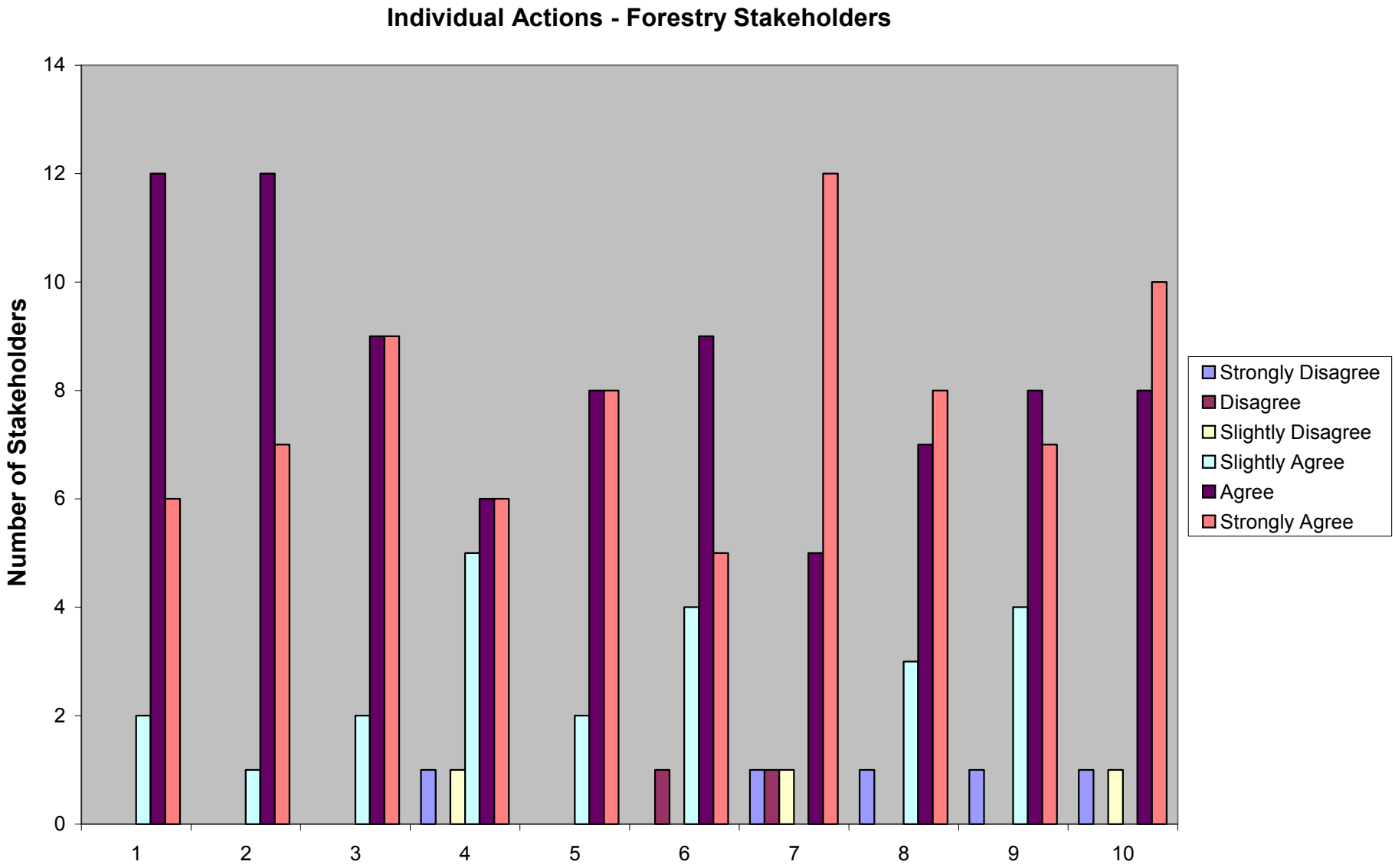
Statement	Agreement (Rank) Forest	Agreement (Rank) Water	Consensus (%) Forest	Consensus (%) Water
Purchase energy efficient lighting and appliances.	3.4 (4.5)	4.5 (3)	60.0	76.5
Incorporate energy efficiency into construction or renovation/repair of one's home.	3.6 (3)	4.6 (2)	60.0	82.3
Consider fuel efficiency (mpg) when purchasing an automobile.	3.7 (1.5)	4.8 (1)	45.0	88.2
Consider purchasing an alternate fuel vehicle.	2.5 (10)	3.4 (7)	31.6	41.2
Use public transit when possible.	3.7 (1.5)	3.7 (6)	44.4	58.8
Car pool on a regular basis.	2.8 (9)	2.9 (8)	47.4	47.1
Support local action to reduce uncontrolled development (sprawl).	3.3 (6)	4.0 (4)	60.0	58.8
Support local action to encourage mixed use development to reduce use of automobile.	3.1 (7)	3.9 (5)	42.1	47.1
Purchase, from their electricity provider, at least some renewable energy.	2.9 (8)	2.3 (10)	40.0	53.3
Generate electricity, where feasible, with renewable energy.	3.4 (4.5)	2.5 (9)	50.0	53.3

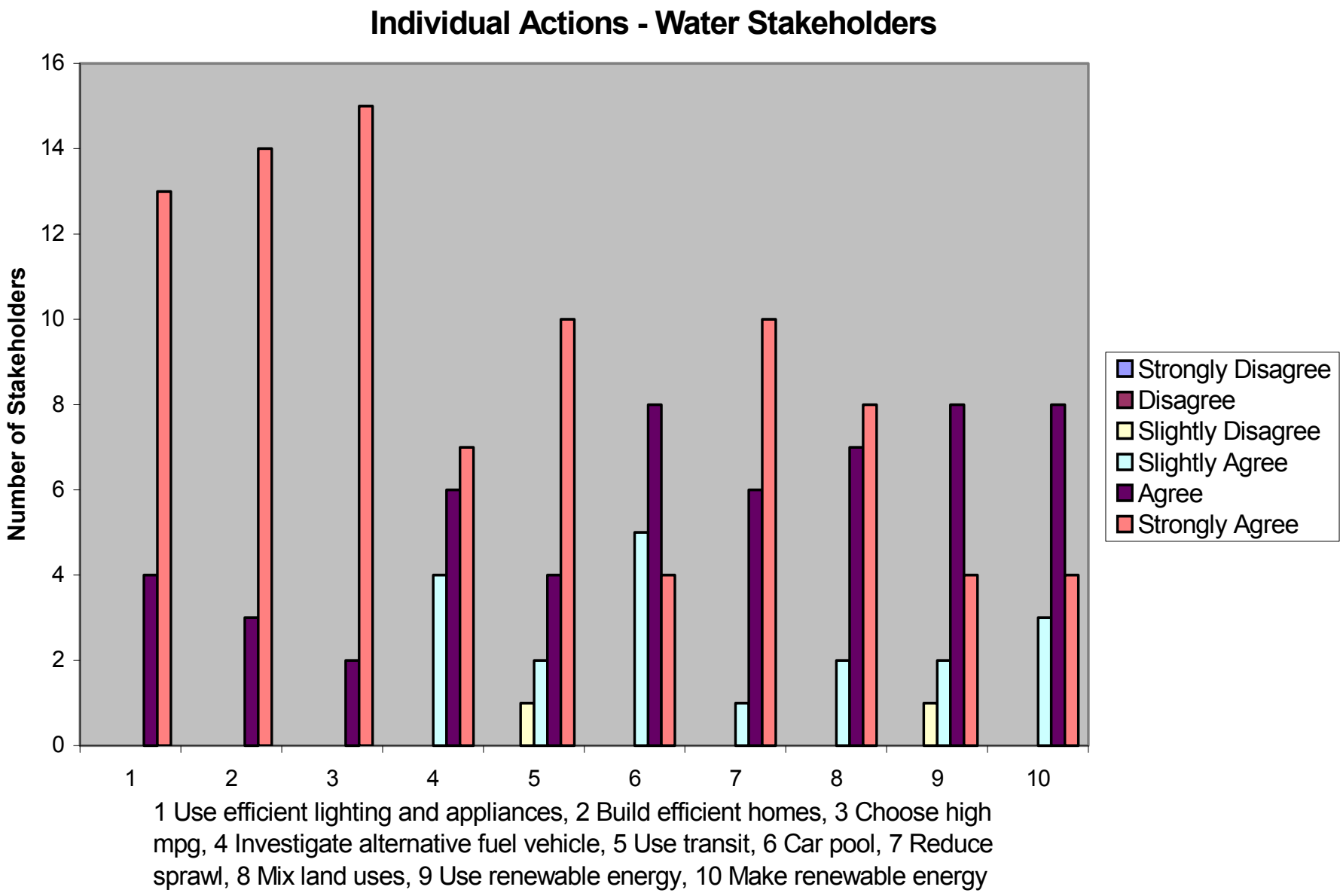
BUSINESS AND INDUSTRY ACTIONS

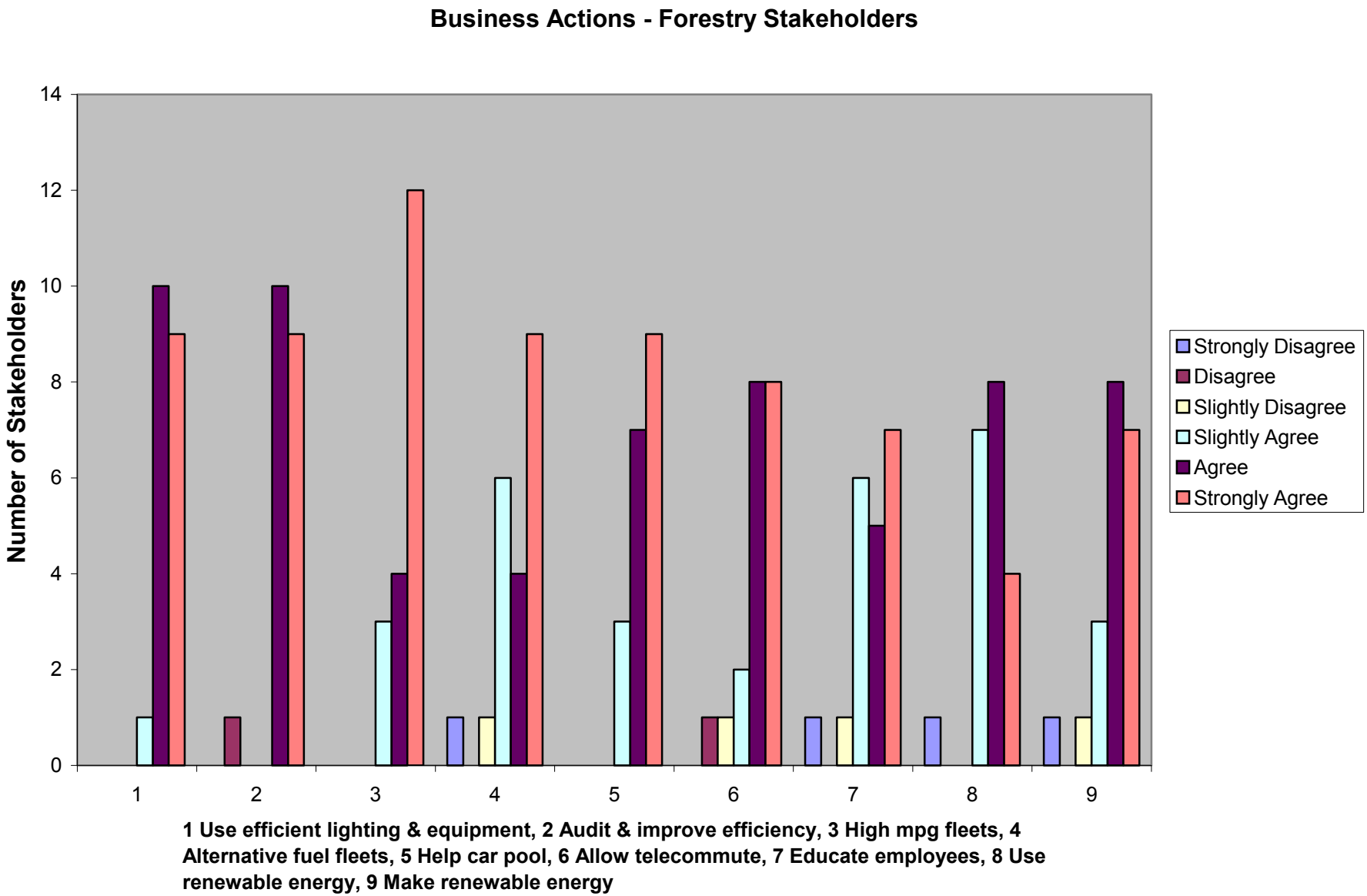
Statement	Agreement (Rank)		Consensus (%)	
	Forest	Water	Forest	Water
Purchase energy efficient lighting and equipment.	3.8 (2)	4.9 (1)	50.0	94.1
Conduct an energy audit and make energy efficiency facility and process improvements.	3.6 (3.5)	4.4 (3)	50.0	70.6
Consider fuel efficiency (mpg) when purchasing fleet automobiles.	3.9 (1)	4.6 (2)	63.2	82.3
Consider purchasing an alternate fuel vehicles for fleet purposes.	2.7 (6.5)	4.1 (4)	42.9	58.8
Assist employees in using car-pooling.	3.6 (3.5)	3.8 (6.5)	47.4	47.1
Make telecommuting available to employees.	3.1 (5)	3.5 (8)	40.0	50.0
Educate employees about energy efficiency and individual actions they can take.	2.5 (8)	4.0 (5)	35.0	62.5
Purchase, from their electricity provider, at least some renewable energy.	2.3 (9)	3.4 (9)	40.0	46.7
Generate electricity, where feasible, with renewable energy.	2.7 (6.5)	3.8 (6.5)	40.0	46.7

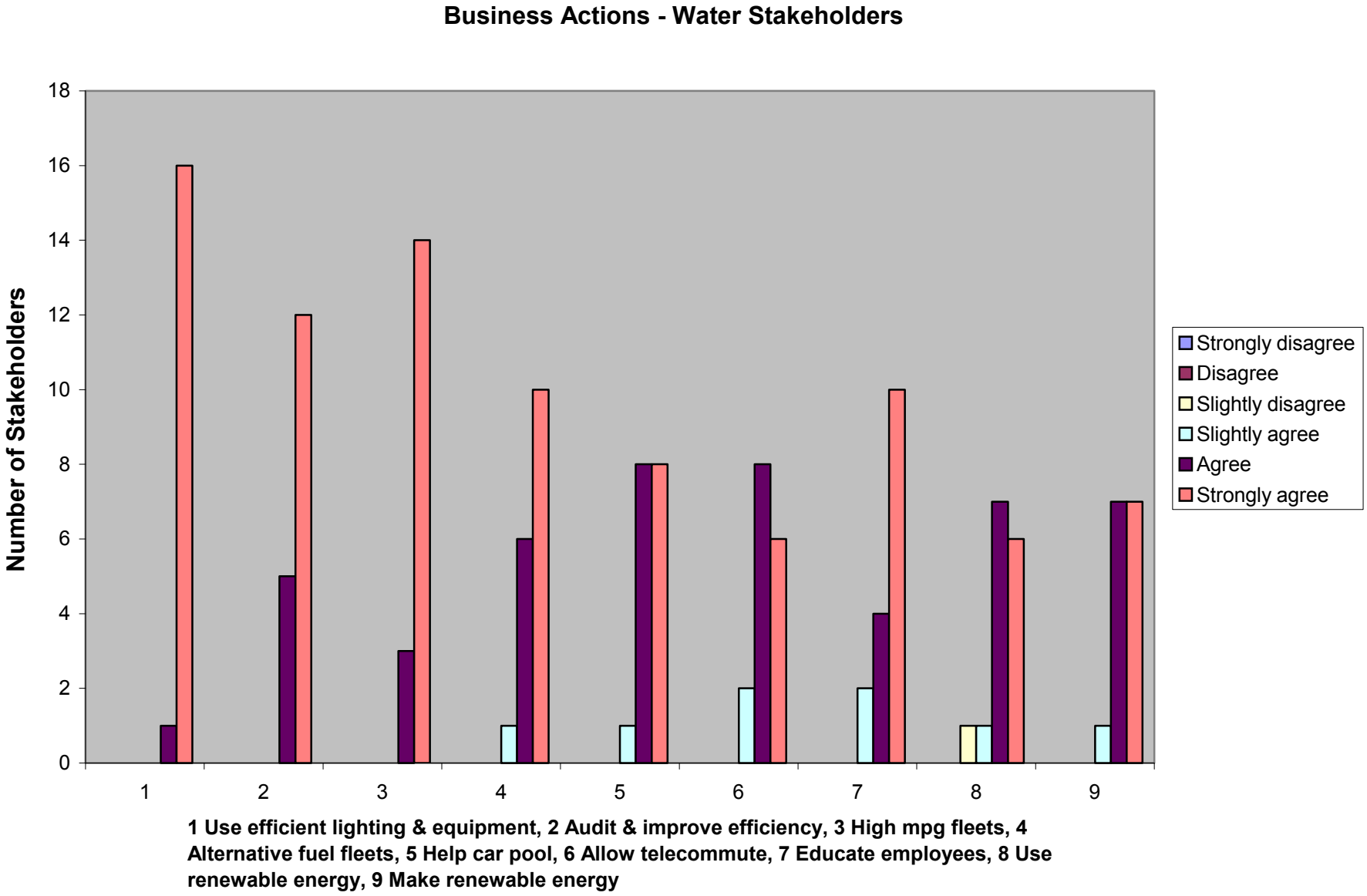
1 Understand science, 2 Cause is warming, 3 Local impacts exist, 4 Local impacts increase, 5 Human caused, 6 Individuals should act, 7 Industry & business should act, 8 NGOs should act

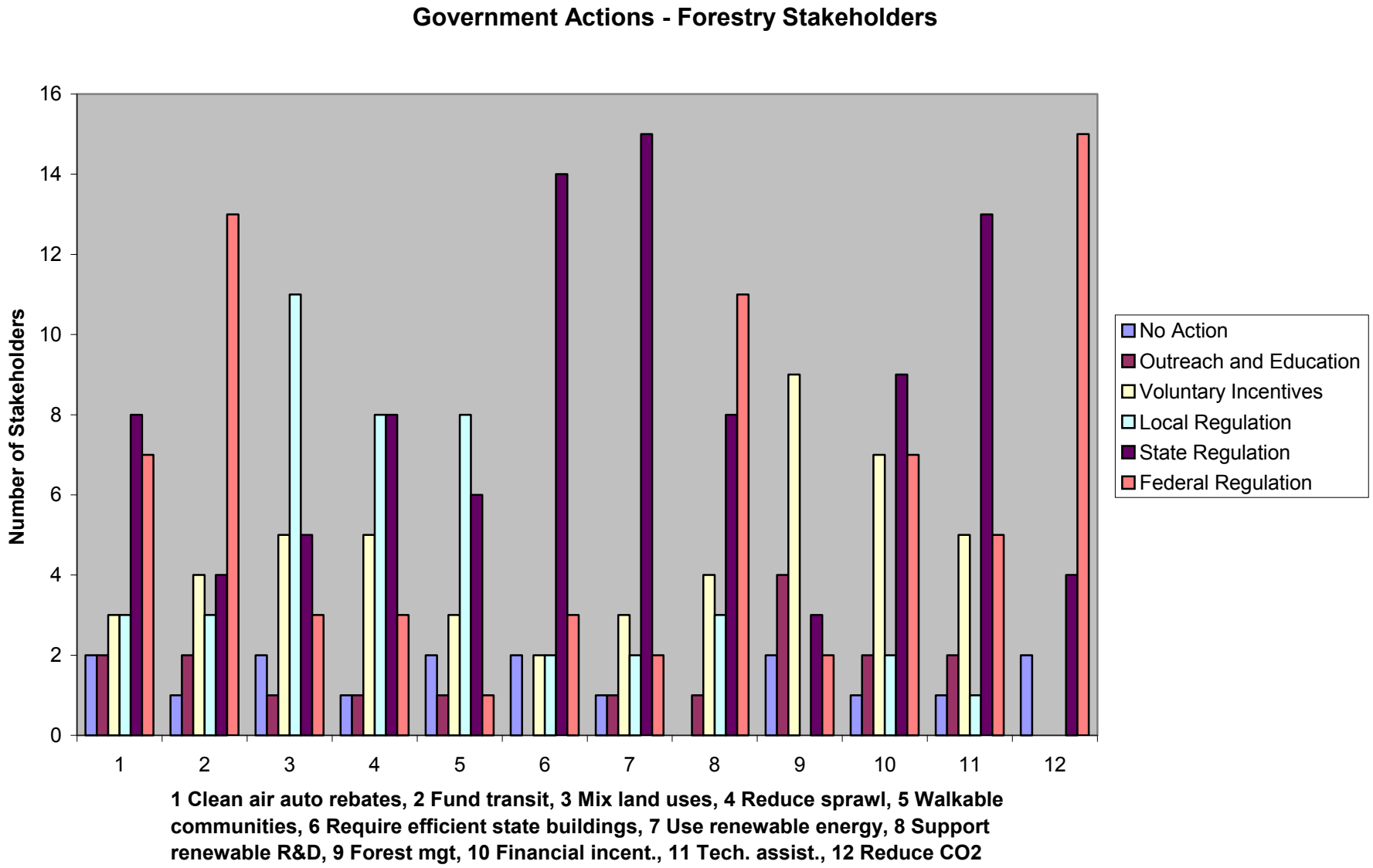

Measuring Stakeholder Consensus - Water Stakeholders
Number of stakeholders
16
14
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
Strongly disagree
Disagree
Slightly disagree
Slightly agree
Agree
Strongly agree
1 Understand science, 2 Cause is warming, 3 Local Impacts exist, 4 Local impacts increase, 5 Human cause, 6 Individuals should act, 7 Industry & business should act, 8 NGOs should act

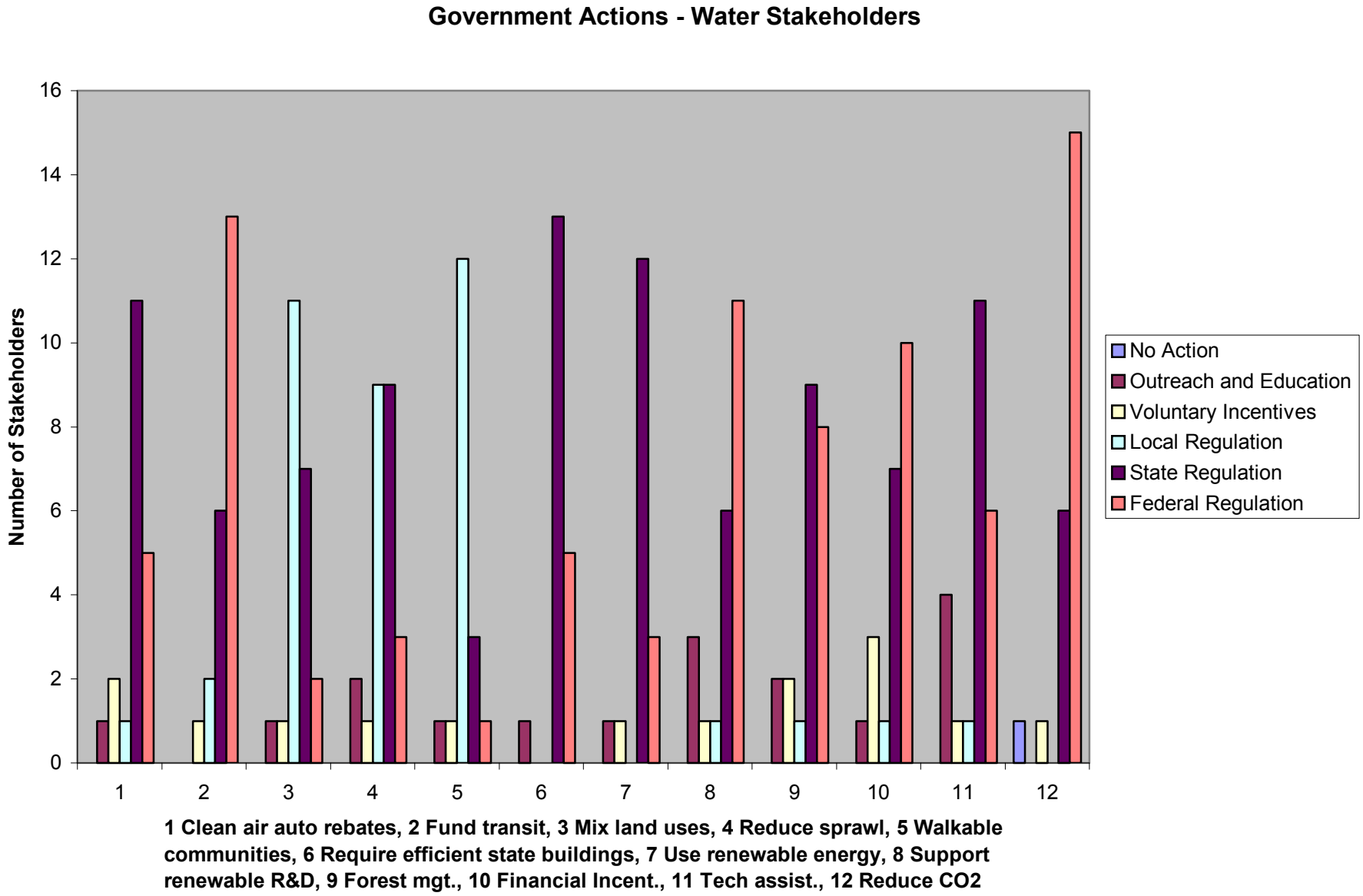

Individual Actions - Forestry Stakeholders
Number of Stakeholders
0
2
4
6
8
10
12
14
1
2
3
4
5
6
7
8
9
10
Strongly Disagree
Disagree
Slightly Disagree
Slightly Agree
Agree
Strongly Agree
1 Use efficient lighting & appliances, 2 Build efficient homes, 3 Choose high mpg, 4 Investigate alternative fuel vehicles, 5 Use transit, 6 Car pool, 7 Reduce sprawl, 8 Mix land uses, 9 Use renewable energy, 10 Make renewable energy


Individual Actions - Water Stakeholders
Number of Stakeholders
0
2
4
6
8
10
12
14
16
1
2
3
4
5
6
7
8
9
10
Strongly Disagree
Disagree
Slightly Disagree
Slightly Agree
Agree
Strongly Agree
1 Use efficient lighting and appliances, 2 Build efficient homes, 3 Choose high mpg, 4 Investigate alternative fuel vehicle, 5 Use transit, 6 Car pool, 7 Reduce sprawl, 8 Mix land uses, 9 Use renewable energy, 10 Make renewable energy


Business Actions - Forestry Stakeholders
Number of Stakeholders
0
2
4
6
8
10
12
14
1
2
3
4
5
6
7
8
9
Strongly Disagree
Disagree
Slightly Disagree
Slightly Agree
Agree
Strongly Agree
1 Use efficient lighting & equipment, 2 Audit & improve efficiency, 3 High mpg fleets, 4 Alternative fuel fleets, 5 Help car pool, 6 Allow telecommute, 7 Educate employees, 8 Use renewable energy, 9 Make renewable energy


Business Actions - Water Stakeholders
Number of Stakeholders
0
2
4
6
8
10
12
14
16
18
1
2
3
4
5
6
7
8
9
Strongly disagree
Disagree
Slightly disagree
Slightly agree
Agree
Strongly agree
1 Use efficient lighting & equipment, 2 Audit & improve efficiency, 3 High mpg fleets, 4 Alternative fuel fleets, 5 Help car pool, 6 Allow telecommute, 7 Educate employees, 8 Use renewable energy, 9 Make renewable energy


Government Actions - Forestry Stakeholders
Number of Stakeholders
0
2
4
6
8
10
12
14
16
1
2
3
4
5
6
7
8
9
10
11
12
No Action
Outreach and Education
Voluntary Incentives
Local Regulation
State Regulation
Federal Regulation
1 Clean air auto rebates, 2 Fund transit, 3 Mix land uses, 4 Reduce sprawl, 5 Walkable communities, 6 Require efficient state buildings, 7 Use renewable energy, 8 Support renewable R&D, 9 Forest mgt, 10 Financial incent., 11 Tech. assist., 12 Reduce CO2


Government Actions - Water Stakeholders
Number of Stakeholders
0
2
4
6
8
10
12
14
16
1
2
3
4
5
6
7
8
9
10
11
12
No Action
Outreach and Education
Voluntary Incentives
Local Regulation
State Regulation
Federal Regulation
1 Clean air auto rebates, 2 Fund transit, 3 Mix land uses, 4 Reduce sprawl, 5 Walkable communities, 6 Require efficient state buildings, 7 Use renewable energy, 8 Support renewable R&D, 9 Forest mgt., 10 Financial Incent., 11 Tech assist., 12 Reduce CO2